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December 15, 1983

Energy Research Abstracts

Abstracts 55349-56812

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic subscribers and $150.00 for subscribers outside the North American continent, except as listed below for *DOE Patents Available for Licensing (PAL)*. A single issue is $7.00 (domestic) and $14.00 (outside the North American continent).

Current Energy Patents (CEP)

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Fusion Energy Update (CFU)

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB83-915300.

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A monthly abstract journal devoted to information on the utilization of solar energy, including biomass and tidal and wind power. Available as PB83-914500.

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Nuclear Reactor Safety (NRS)

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Radioactive Waste Management (RWM)

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB83-902900.

INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts*. In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

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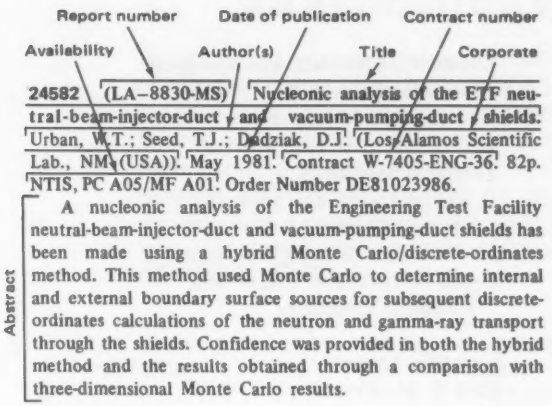
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
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Availability
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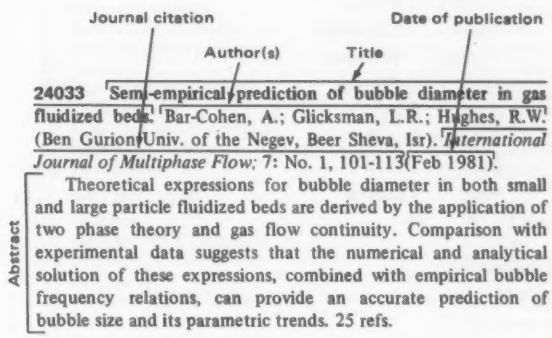
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
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• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	Los Alamos National Lab., NM (USA)	
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• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–8830-MS	6:24582	NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 55867, 55868

55349 (ORNL—5990) Fossil-energy program. Quarterly progress report for June 30, 1983. McNeese, L.E. (Oak Ridge National Lab., TN (USA)). Aug 1983. Contract W-7405-ENG-26. 266p. NTIS, PC A12/MF A01. Order Number DE83017977.

This quarterly report covers the progress made during the period March 31 through June 30 for the Oak Ridge National Laboratory research and development projects that are carried out in support of the increased utilization of coal and other fossil fuels as sources of clean energy. These projects are supported by various parts of DOE including Fossil Energy, Basic Energy Sciences, Office of Health and Environmental Research, Office of Environmental Compliance and Overview, the Electric Power Research Institute, and by the Tennessee Valley Authority and the EPA Office of Research and Development through inter-agency agreement with DOE.

0104 Processing

REFER ALSO TO CITATION(S) 55394, 55425, 55434, 55435, 55574, 55723, 55724, 55725

55350 (ANL/FE—83-20) Instrumentation and control for fossil energy. Quarterly technical progress report, January-March 1983. Raptis, A.C. (Argonne National Lab., IL (USA)). Apr 1983. Contract W-31-109-ENG-38. 92p. NTIS, PC A05/MF A01. Order Number DE84000984.

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Progress during the quarter, January-March, 1983 in the Program, Instrumentation and Control for Fossil Energy, is reported. Work reported includes developments in several tasks related to coal gasification and liquefaction processes. Some of these tasks involved the measurement of the solid component feed rate in solid/gas and solid/liquid feed lines and similar process streams utilizing a newly developed electronics package to compute the solids mass flow rate, and velocity and density sensing hardware based on capacitive, acoustic, and gamma transmission techniques. Other tasks include instruments to measure temperature and level in coal gasification and liquefaction systems, and review, evaluation, and support of existing process plants. This report also covers activities to operate, maintain, and modify the Solids/Gas Flow Test Facility and Slurry Loop Test Facility at Argonne National Laboratory. 19 references, 38 figures, 8 tables.

55351 (BMFT-FB-T—83-151) Generation of syngas, towngas and SNG by pressure gasification of lumpy hard coals with oxygen - Lurgi fixed-bed pressure gasification. Heinrich, G.; Kraut-Giesen, G.; Schaefer, W.; Rupert, I. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1983. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83751347.

Portions are illegible in microfiche products; With 13 refs., 5 tabs., 28 figs.

1. Objectives: With the further development of the Lurgi-pressure gasification and the increase of the gasification pressure from 25 to 100 bar the specific gasification capacity (coal-throughput, gasgeneration) and the heating value (methane content of the raw gas) should be increased, the yield of by-products decreased and feed coal basis enlarged. 2. Test Plant Operation: Within 21 runs, each about 70 to 500 hours depending on the special target and about 3800 operating hours, in total 13000 tons of coal were processed. Different kinds of coal as well as agglomerated fines with ash contents from 20 to 50% were used. 3. Results: The gasification pressure was increased step by step from 25 to 94 bar whilst the methane content in the raw gas was raised from 9 to more than 17 vol-%. With respect to the methanation, necessary for the SNG-production, this means that about 50% of the methane is already generated in the gasifier. The high operating pressure caused no problems; the different feed coals as far as investigated, were used without difficulties, in principle. The specific gas yield raised from 4400 to 9200 $m^3/(m^3xh)$, the specific oxygen demand dropped by about 10 to 20%. The facilities and materials needed for the high pressure gasifier habe been proven suitable. With a further operating period the variation of feed coal, the yield of condensable hydrocarbons and tests of some special components are the most important targets.

55352 (CONF-8210168—, pp 199-212) Great Plains coal-gasification project: status report. Cox, J.B. (ANG Coal Gasification Co., Detroit, MI). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The $2 billion Great Plains facility will gasify 14,000 tons of lignite a day using Lurgi-process technology. This article gives a brief overview of the process and describes the organization and development of the Great Plains Gasification Associates, which formed during the past decade to develop an economical way to produce natural gas, feedstocks, and marketable by-products from coal. 3 figures, 2 tables. (DCK)

55353 (CONF-8210168—, pp 213-220) New technologies for coal: utility perspective. McCrackin, F.A. (Southern California Edison Co., Los Angeles). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Southern California Edison Company, in order to meet immediate increasing demands for electricity without augmenting the nation's dependence on foreign oil, is actively seeking technologically and economically viable non-oil technologies ready for commercialization. Environmental issues, capital requirements, and the domestic availability of the energy resources used will be additional considerations. Much of Edison's effort will go toward advanced coal-combustion and coal-gasification projects. 2 figures, 4 tables.

55354 (DOE/ET/10143—3-Rev.) H-Coal Pilot Plant: operating test results with No. 6 fuel oil. Rev. Bernard, R.F.; Morrison, J.A.; Dabkowski, M.J.; Chen, C.L. (Ashland Synthetic Fuels, Inc., KY (USA)). 15 Jul 1980. Contract AC05-76ET10143. 36p. NTIS MF A01. Order Number DE84000550.

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This report presents test results obtained while operating the H-Coal Pilot Plant with No. 6 fuel oil during May 16 to May 19, 1980. The test results are presented in three parts: Part I - Summary of Operating Results; Part II - L-201A Slurry Heater Tests Results; and Part III - Fractionation System Test Results.

55355 (DOE/ET/10143—8-Rev.) H-Coal Pilot Plant: Coal run No. 6 with Illinois coal in Syncrude Mode. Topical report No. T-8. Morrison, J.A.; Dabkowski, M.J.; Chen, C.L.; Malone, D.P. (Ashland Synthetic Fuels, Inc., KY (USA)). 20 May 1981. Contract AC05-76ET10143. 84p. NTIS MF A01. Order Number DE84000552.

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This report presents the results of Coal Run 6 at the H-Coal Pilot Plant in Catlettsburg, Kentucky. The Run was made with Illinois No. 6 coal in the Syncrude Mode. Coal was introduced on February 17 and the Run was terminated on April 3, 1981. During this time, coal was continuously fed to the Reactor System for a period of 45.5 days.

55356 **(DOE/ET/10143—19) H-Coal Pilot Plant: radiation safety.** Gray, J.H. (Ashland Synthetic Fuels, Inc., KY (USA)). Aug 1983. Contract AC05-76ET10143. 159p. NTIS, PC A08/MF A01. Order Number DE83017633.

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During the design phase of the H-Coal Pilot Plant the instrumentation evaluation for the high pressure vessels indicated the need for nuclear gauges. Therefore, thirty-eight nuclear gauges were installed on 18 vessels at the plant. Their uses ranged from empty/full switches to determining the density of a flowing hydrocarbon stream. Installation and use of nuclear gauges requires a Radioactive Material License granted by Kentucky Department for Human Resources Radiation Control Branch. The processing time from application to license issuance was 13 months. The Radiation Safety program involved preparing Vessel Energy Procedures, marking vessels, writing a Nuclear Safety Manual, and holding training sessions for plant employees. In addition to training personnel in the use of the nuclear gauges, monitoring of the instruments was required. Monitoring was accomplished by wipe testing, surveys and exposure badges. All monitoring results clearly demonstrated the safety of the nuclear gauges. ASFI made any needed repairs and elected on a few installations to add a small amount of shielding to lower the radiation field intensity. These cases were only minor and never involved any risk to plant personnel. The experience at the H-Coal Plant with nuclear gauges has shown them to be safe and sound instruments. Monitoring was performed more often than required, and it can be done less frequently at similar installations. The Radiation Safety Program with its signs, documents, procedures and training sessions was quite successful. Many of the Program's features are applicable in any plant with nuclear gauges.

55357 **(DOE/ET/10143—33) H-Coal Pilot Plant: University of Kentucky Chemical Engineering Department evaluation of reverse-osmosis treatment of treated H-Coal wastewater.** Churton, B.M. (Ashland Synthetic Fuels, Inc., KY (USA)). May 1983. Contract AC05-76ET10143. 135p. NTIS MF A01. Order Number DE84000546.

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As part of an overall environmental evaluation of the H-Coal liquefaction process, sour water treatability studies have been performed. These studies consisted of the listed major components. These studies indicate that H-Coal Sour Water can be successfully treated for reuse or for discharge to public waters. In one of these projects the University of Kentucky performed an evaluation of reverse osmosis (R.O.) membranes and their treatment efficiency on treated H-Coal wastewater. The study had the following conclusions: Both the Dupont and Film-Tec R.O. membranes had chloride, sodium, conductivity and total organics rejections greater than 85%; the Albany R.O. membrane module rejections (at 200 psi) dropped to 70% at high feed waste concentrations; the dark color of the H-Coal wastewater (attributed to the presence of hydroquinone, resorcinol, catechol and other similar types of light sensitive compounds) experienced membrane rejection of greater than 95% with all three membranes; the decrease in flux rate across the membrane due to fouling and concentration polarization was in the range of 0% to 30% for the three membranes after correcting for osmotic pressure effects; the temperature studies (25°C to 38°C) demonstrated that the water flux rate could be increased substantially by operating at 38°C without a significant loss in conductivity rejection; the total organic carbon present in the H-coal wastewater (which is biotreated Powdered Activated Carbon Treatment effluent) was shown to be a mixture of furmaric, maleic and formic acids; and based on the extensive experimental data, it can be concluded that the biotreated H-Coal wastewater could be concentrated to a range of 5X to 10X. At high conversion levels the drop in permeate quality must be considered for water reuse criteria. The detailed results of the University of Kentucky study are presented in this report as submitted to and edited by ASFI.

55358 **(DOE/ET/10143—34) H-Coal Pilot Plant: University of Kentucky Institute for Mining and Minerals Research - findings from the corrosion-monitoring program at the H-Coal Pilot Plant.** Ragle, H.V. (Ashland Synthetic Fuels, Inc., KY (USA)). May 1983. Contract AC05-76ET10143. 160p. NTIS, PC A08/MF A01. Order Number DE84000037.

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One objective of the H-Coal Pilot Plant was to evaluate materials of construction and establish guidelines for materials for commercial application. In order to meet that objective, a Corrosion Monitoring Program was begun in May 1980. The University of Kentucky Institute for Mining and Minerals Research (IMMR), under ASFI Subcontract HC-59, prepared corrosion coupons for exposure in various areas of the H-Coal process, primarily in the high pressure hydrogenation section, but also including the atmospheric fractionator and sour water and sour gas areas. A total of 33 racks consisting of combinations of 32 different alloys were exposed during four different exposure periods (approximately 200 coupons per exposure period) from May 1980 to November 1982. The coupons were exposd to four different types of coal: Kentucky No. 11, Illinois No. 6, Kentucky No. 9, and Wyodak coal separately and/or in various combinations. To extract as much data as possible, the coupons were examined by various techniques including weight loss determination, metallographic examination and microanalytical examination. The original data, results of the various examinations, trend analysis, discussion of meaningful correlations, and conclusions are presented in this report.

55359 **(DOE/ET/10143—35) H-Coal Pilot Plant: final equipment inspection (with separate proprietary appendix).** Curnutte, M.L.; Ragle, H.V. (Ashland Synthetic Fuels, Inc., KY (USA)). Jun 1983. Contract AC05-76ET10143. 356p. NTIS, PC A16/MF A01. Order Number DE84000554.

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Since completion of the second major maintenance turnaround on February 28, 1982, the H-Coal Pilot Plant operated for 133.2 days on coal and 54.8 days on oil circulation. Approximately 9600 tons of Wyodak, 12,976 tons of Illinois No. 6 and 3329 tons of Kentucky No. 9 coal (see analyses, Attachment 1, Page 1.0) have been processed in three separate test runs. On November 11, 1982, the final test run was voluntarily terminated following depletion of operational funds and satisfactory completion of operating objectives. The plant was then readied for the third and final shutdown inspection. This report summarizes the observations and results of the final equipment inspection for the period of November 22, 1982, to January 22, 1983.

55360 **(DOE/ET/10143—36) H-Coal Pilot Plant: letdown-valves experience - Run Nos. 8, 9, 10.** Bond, N.D.; Qualls, G.E. (Ashland Synthetic Fuels, Inc., KY (USA)). Jun 1983. Contract AC05-76ET10143. 133p. NTIS MF A01. Order Number DE84000547.

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Equipment used in direct liquefaction processes is subjected to mixtures of coal fines, ash and oil derived from high sulfur coal in a high pressure and high temperature environment. This report reviews the experiences and development of letdown valves used in high pressure letdown service at the H-Coal Pilot Plant in Calettsburg, Kentucky. Included is the operating experience of the various letdown valves used, development of trim design and trim material selections for Coal Run Nos. 8, 9 and 10. Valves used during this period were Cameron, Kieley and Mueller, Hammel-Dahl, Masoneilan Sasol and Masoneilan Prototype.

55361 **(DOE/ET/10143—37) H-Coal Pilot Plant: Coal Run No. 11 with Illinois No. 6 and Kentucky No. 9 coals in the Syncrude Mode (with separate proprietary appendix).** Choksey, P.J.; Harris, E.C.; Morrison, J.A.; Newby, G.L.; Richardson, D.V.; Young, F.E. (Ashland Synthetic Fuels, Inc., KY (USA)). Jun 1983. Contract AC05-76ET10143. 215p. NTIS, PC A10/MF A01. Order Number DE84000555.

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Coal Run No. 11 was made at Syncrude Mode operating conditions using bituminous coal (Illinois No. 6 and Kentucky No. 9 coal). Out of the 92.6 days following the initiation of coal feed, coal was fed 78 days for an overall on-stream factor of 83%. The only significant interruption was when it was necessary to depressure in order to clear the catalyst withdrawal line. Two material balances were obtained: one on Illinois No. 6 coal and one on Kentucky No. 9. The results of these material balances are compared in Table 1-1. Overall, the yields are quite comparable. Other accomplishments were: Slurry flow was successfully split to the two-pass charge heater; the Slurry Preparation Drum was operated at elevated temperature for almost the entire run compared to about 250°F during the previous runs; the reactor was operated at the commercial gas velocity; the Waste Treatment Plant operated successfully above the design loadings; operating experience was obtained on the A and B Reactor Feed Pumps which operated at commercial plunger speed (100 rpm); the Bowl Mill was tested at three different feed rates; hydrogen consumption as measured at the PDU was verified; the Reactor Feed Heater was performance-tested four times; the Iscaflow Weigh Feeder was evaluated as a commercial weighing device; and in excess of 6000 tons of flaked residuum were collected for a gasifier demonstration.

55362 **(DOE/ET/10143—38) H-Coal Pilot Plant: Rotating-Equipment Test Program (with separate proprietary appendix).** McCann, L.T. (Ashland Synthetic Fuels, Inc., KY (USA)). Jun 1983. Contract AC05-76ET10143. 290p. NTIS, PC A13/MF A01. Order Number DE84000548.

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During design of the H-Coal Pilot Plant, three generic types of pumps were identified as technical risks inherent to coal liquefaction: the Reactor ebullating pump, the Reactor high pressure slurry feed pumps and high temperature centrifugal slurry pumps. Development of commercial material selection data, maintenance and operating procedures and scale-up data for these pumps was an important objective. In early 1982, a Rotating Equipment Test Program (RETP) was initiated with the intention of significantly increasing the technical and documentation effort devoted to these pumps. The results of this RETP program in combination with earlier work at the Pilot Plant and related work in similar commercial pumping applications provide a completely adequate basis for design, procurement, operation and maintenance of commercial size ebullating and hot centrifugal pumps. Progress in the development of commercial high pressure slurry feed pumps fell somewhat short of initial objectives; however, the work at the Pilot Plant removed the problem from the major technical risk list. A number of interesting developments at other facilities offer strong promise of providing a fully satisfactory design basis for commercial high pressure slurry feed pumps. These pumps, in the absence of further development and based only on experience at the H-Coal Pilot Plant, would require a major investment in piped-up spares and spare parts to acheive acceptable on-stream times.

55363 **(DOE/ET/10143—39) H-Coal Pilot Plant: critical heat-exchanger performance in the H-Coal Pilot Plant (with separate proprietary appendix).** Malone, D.P. (Ashland Synthetic Fuels, Inc., KY (USA)). Jun 1983. Contract AC05-76ET10143. 75p. NTIS, PC A04/MF A01. Order Number DE84000551.

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Performance testing of four critical heat exchangers in the H-Coal Pilot Plant was conducted during Run No. 11. Overall heat transfer coefficients were calculated for each exchanger. An analysis and discussion of possible fouling mechanisms is also presented.

55364 **(DOE/ET/10143—40) H-Coal Pilot Plant: block-valve experience, Coal Run No. 11.** Qualls, G.E.; Ragle, H.V. (Ashland Synthetic Fuels, Inc., KY (USA)). Jun 1983. Contract AC05-76ET10143. 33p. NTIS, PC A03/MF A01. Order Number DE84000549.

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Equipment used in direct liquefaction processes is subjected to mixtues of coal fines, ash, and oil derived from high-sulfur coal in a high-pressure and high-termperature environment. This report reviews the experiences and development of block valves used in high-pressure letdown service and other areas of the H-Coal Pilot Plant in Catlettsburg, Kentucky. Included are block-valve-cycle data and information pertaining to seat materials and various coatings and substrates used for the balls. Inspection data obtained after Coal Run No. 11 are presented. Valves from five manufacturers are discussed, with information on block valves that performed well and on those that failed.

55365 **(DOE/ET/10143—41) H-Coal Pilot Plant: letdown valves experience - Run No. 11.** Qualls, G.E.; Bond, N.D. (Ashland Synthetic Fuels, Inc., KY (USA)). Jul 1983. Contract AC05-76ET10143. 81p. NTIS, PC A05/MF A01. Order Number DE84000553.

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This report is the third and final Topical Report describing the development of the various Letdown valves used for the two-stage high presure and temperature coal slurry Letdown System at the H-Coal Pilot Plant. Operating experience during Coal Run No. 11 is covered in this report. The valves tested during this period include models supplied by Cameron, Kieley and Mueller, Hammel-Dahl, and Masoneilan.

55366 **(DOE/ET/10532—T13) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, January-March 1983.** Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). May 1983. Contract AC22-76ET10532. 27p. NTIS, PC A03/MF A01. Order Number DE83013131.

Coal-derived product from the Integrated Two-Stage Liquefaction (ITSL) Process is being upgraded in a single step to product containing 5 to 10% aromatics, less than 0.2 ppM nitrogen, less than 50 ppM oxygen, and about 2 ppM sulfur. The catalyst is Chevron's ICR 106 catalyst which appears stable after 1500 h of pilot plant operation.

55367 **(DOE/MC/14771—1475) Feasibility study of coal-fracture enhancement using aqueous sodium hypochlorite. Final report.** Pelofsky, A.H.; Dittman, F.W. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Chemical and Biochemical Engineering). [nd]. Contract AC21-80MC14771. 58p. NTIS, PC A04/MF A01. Order Number DE83017983.

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This research project was a pilot-scale simulation in the laboratory of the treatment of underground coal deposits by solutions of sodium hypochlorite (NaOCl) in water. Sub-bituminous coal packed tightly in a steel reactor 23" long x 29" I.D. was exposed to the solution pumped through at a rate of 1 gallon per hour. Flow-pressure drop measurements were made before and after each run; from these data, permeability was calculated by means of Darcy's equation. Three runs were made - 12.3 wt% NaOCl for 16 hours; 10.9 wt% NaOCl for 17.5 hours; and in the last run, 6.5 wt% NaOCl for three 15-hour periods, followed by 11 wt% NaOCl for 15 hours. These were designated, respectively, as Runs No. 1, No. 2, and Nos. 3-1, 3-2, 3-3, and 3-4. In Run No. 1, permeability of the coal bed was increased by 6% to 13%. In Run No. 2, however, the permeability increased by a factor of 5.4 to 6.85, i.e., 440 to 585%. The increase from Run No. 1 to Run No. 2 is believed to be due to a better location of the feed inlet, plus the installation of baffles to direct the solution toward the centerline of the coal bed. Run 3-1, using relatively weak solution, showed a decrease of about 60% in permeability compared to that of the coal before treatment. Runs 3-2 and 3-3 brought the permeability back up to about 70% of the

original value. Run 3-4 in which 11.0 wt% NaOCl solution was used, resulted in a 13 to 29% increase in permeability over the original value. Twenty-four thermocouples were symmetrically distributed within the coal bed. The increases of temperature due to reaction, which were different for each thermocouple, permitted the tracing of the path of maximum reaction within the coal bed. 31 figures.

55368 **(DOE/MC/19265—1479) Recommended documentation plan for the FLAG and CHEMFLUB computer codes.** (BDM Corp., Houston, TX (USA)). 2 Sep 1983. Contract AC21-82MC19265. 102p. NTIS, PC A06/MF A01. Order Number DE84000446.

Reviews have been conducted on both FLAG and CHEMFLUB's documentation and computer codes. The documentation of both models is: (1) incomplete, (2) confusing, (3) not helpful to the reader, (4) filled with extraneous information and (5) lack claimed versatility in analyzing coal gasifier systems. The documentation is such that the computer coding itself must be used as a reference to complete the documentation. Once the codes are set up they are relatively easy to run. We have exercised both of them. Most of our efforts thus far have been concentrated on FLAG because of its importance and complexity. FLAG in its present form can not be expected to yield meaningful data applicable to coal gasifier systems. The reasons for this are twofold. First, the model is incorrect in describing some aspects of fluid particle behavior in coal gasifier systems. Second, the numerical formulation/solution methodology is incorrectly implemented and introduces spurious numerical effects, thereby obscuring the physics of the model. In brief, this means that resulting calculations are not correctly related to the physics. CHEMFLUB, while less extensively exercised, shows that it should be no surprise that CHEMFLUB is best utilized as a tool for generating first approximations. We have concluded from these reviews that we cannot perform meaningful comparisons as required under tasks 3.3, 3.4, and 3.5 without first reconstructing and correcting when necessary the physical/numerical models. A plan is presented for accomplishing this reconstruction/modification.

55369 **(DOE/PC/50046—2) Detection and prevention of coking in coal liquefaction. Report for the Technical Data Analysis Program.** Schimd, B.K. (Pittsburg and Midway Coal Mining Co., Denver, CO (USA)). Sep 1983. Contract AC22-82PC50046. 86p. NTIS, PC A05/MF A01. Order Number DE84000056.

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Potential areas of coke formation in the SRC-II process are (1) slurry preheater, (2) reactor, (3) reactor effluent separator, (4) atmospheric fractionator preheater, (5) vacuum tower preheater. Two readily measurable analytical parameters are available to reveal potential coke formation in these areas. At the typical design conditions of the demonstration plant, there is apparently no problem in the preheater with rapid coke formation of the type which could lead to a sudden shutdown. Although coke deposits may build up gradually near the preheater outlet, the rate of deposition will probably be sufficiently low to permit burnout at the annual shutdown. Coke deposits in the reactor appear to be influenced by the total mixing energy applied to the system. At typical demonstration plant design conditions, the total mixing energy (supplied entirely by the process gas at a superficial velocity of about 9 cm/sec) appears to be sufficient to avoid coking, except for minor buildup on the walls and/or the bottom cone. Coking in the reactor effluent separator can be prevented by operating at 780°F or lower, with a hydrogen sparge at a rate equivalent to a superficial gas velocity of 1 cm/sec or higher. Atmospheric tower feedstocks containing about 50% naphtha are susceptible to coking during preheating, but little coking is observed when naphtha concentration is as low as 25%. Vacuum tower slurry feedstocks have shown evidence of coking during preheating. Preheating this material could be avoided by an alternative design involving preheating of the atmospheric tower bottoms alone, then combining this stream with the vacuum tower slurry feed (already hot).

55370 **(EPRI-AP—3121) Proceedings of the second annual EPRI contractor's conference on coal gasification.** (Electric Power Research Inst., Palo Alto, CA (USA)). May 1983. 560p. (CONF-8210170—). NTIS, PC A24/MF A01. Order Number DE83902657.

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

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This report contains the technical papers presented at the conference. The sessions covered economics, test results from large pilot plants, progress reports on demonstration projects, modeling and simulation studies, bench-scale investigations, and environmental control and monitoring. A separate abstract was prepared for each of the 19 individual presentations.

55371 (EPRI-AP—3121, pp 2.1-2.20) **Economics of the Texaco Gasification Process for fuel-gas production.** Matchak, T.A. (Fluor Engineers, Inc., Irvine, CA). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Results are presented of an economic evaluation of oxygen-blown Texaco-based gasification of 11,000 tons/day of Illinois No. 6 coal for the production of clean intermediate-Btu fuel gas. Results indicate that fuel gas produced by a utility-owned Texaco-based gasification plant has the potential to be lower in cost than equivalent crude oil-derived products. Before such savings can be realized, Texaco's coal-gasification technology must be demonstrated at the scale assumed as the basis for this study, realizing that the first few commercial-scale Texaco-based fuel-gas plants can be anticipated to cost appreciably more than the estimates presented for the mature plants in this report. 4 figures, 5 tables.

55372 (EPRI-AP—3121, pp 5.1-5.27) **Ruhrchemie/Ruhrkohle's demonstration plant of the TCGP: recent progress and developments.** Hibbel, J. (Ruhrchemie AG, Oberhausen, Germany); Materne, W.; Cornils, B.; Langhoff, J.; Duerrfeld, R. May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Ruhrchemie/Ruhrkohle's demonstration plant of the Texaco Coal Gasification Process (TCGP) is on stream since early 1978. The following paper gives information about: the design, technical equipment, experiences so far, and work to be done. It covers especially materials (ceramic and metallic), control devices, and alternative components. 15 figures.

55373 (EPRI-AP—3121, pp 6.1-6.37) **British Gas/Lurgi slagging gasifier.** Sharman, R.B.; Lacey, J.A.; Scott, J.E. (British Gas Corp., London, England). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

The British Gas/Lurgi Slagging Gasifier is outstanding in combining safe, simple, and reliable operation with high overall efficiency in the conversion of coal to gas. The reasons for the advantages of the Slagging Gasifier over competing gasification systems are explained and are shown to apply whether the gas is to be used for electric power generating, synthesis or fuel gas, or to make synthetic natural gas (SNG). The development program at Westfield is summarized. Alternative methods for the utilization of fines and the treatment and recycle of aqueous effluent have been developed and are being optimized. An 8-ft.-diameter gasifier is under construction, and the HCM process for converting gas to SNG will be demonstrated. The 90-day run carried out in 1981 has enabled British Gas to offer full commercial guarantees for gasifiers of 6-ft or 8-ft diameters. 23 references, 8 figures, 10 tables.

55374 (EPRI-AP—3121, pp 8.1-8.43) **KILnGAS status report.** Petersen, G.T. (Allis Chalmers Coal Gas Corp., Milwaukee, WI). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

An overview of the technology and demonstration program of the KILnGAS gasification demonstration program is presented, followed by a status report, a description of the plans for commissioning the demonstration plant in 1983, and a summary of test plans. 8 figures, 20 tables.

55375 (EPRI-AP—3121, pp 9.1-9.11) **Joint Westinghouse/SASOL commercial-scale fluidized-bed coal gasification project.** Wolfinger, R.L.; Salvador, L.A. (Westinghouse Electric Corp., Madison, PA). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

SASOL Ltd., a South African company that established the world's largest coal-to-synthetic-fuels plant more than 30 years ago, and Westinghouse Electric Corporation have jointly undertaken to demonstrate the operability and commercial viability of the pressurized, ash-agglomerating, fluidized-bed process developed by Westinghouse. The firms will design, construct, and operate a nominal 1200-metric-ton/day demonstration plant at the SASOL Two complex. This advanced commercial-scale gasifier plant will operate in the slip-stream mode, using existing coal supply and wastewater treatment facilities, oxygen, and other utilities, and it could feed gas to existing processing units. The joint demonstration will provide an early minimum-cost opportunity to demonstrate the efficiency and economy of a second-generation gasification process. 15 figures.

55376 (EPRI-AP—3121, pp 10.1-10.47) **Simulation of a Texaco gasifier.** Lupa, A.J. (Texaco Inc., Houston, TX). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

The objective of this project is the development of a dynamic simulator of a Texaco entrained coal-fired pilot-plant gasifier. The simple model, initially based on information in the open literature, was built using a proprietary Texaco computer program as the framework. Actual data from the pilot plant at Texaco's Montebello, California, Research Laboratory were used to test the model and adjust it, as necessary. Future emphasis will be on improving the model's ability to simulate steady-state operation of pilot-plant and demonstration-plant gasifiers in an effort to make the model predictive rather than correlative. 22 references, 31 figures, 1 table.

55377 (EPRI-AP—3121, pp 12.1-12.16) **H_2S absorption-system model.** Vysniauskas, T. (Hyprotech Ltd., Calgary, Alberta); Svrcek, W.Y.; Sim, W.D.; Quentin, G.H. May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

A computer simulation model is used to simulate the performance of a Selexol acid gas-treating facility in both steady-state and dynamic mode. The results of two steady-state simulation runs are compared to actual plant data collected from the Selexol system at the Bi-Gas pilot plant in Homer City, Pennsylvania. The agreement is reasonably good. The effect of a transient inlet gas flow rate on the Selexol system is also presented in this article. A 62% ramp increase over 15 minutes was introduced into the system. Plant data for comparison purposes were not available for this run. 3 figures, 3 tables.

55378 (EPRI-AP—3121, pp 13.1-13.22) **Steady-state and dynamic simulation of moving-bed gasifiers.** Denn, M.M. (Univ. of California, Berkeley); Wei, J. May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Steady-state and dynamic models developed to simulate operating characteristics of dry-ash and slagging moving-bed gasifiers are described. The models are fundamental and are based on thermodynamic, kinetic, and transport properties. Model predictions are in agreement with available data. 11 references, 16 figures, 2 tables.

55379 (EPRI-AP—3121, pp 14.1-14.30) **Moving-bed GCC control study oxygen-blown slagging-ash-operation results.** Priestley, R.R. May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

A computer simulation study, a continuation of a moving-bed gasifier combined cycle (GCC) power plant control analysis, has been conducted to investigate the process dynamics and control strategies required for operation of an oxygen-blown, slagging, moving-bed GCC power plant in a utility power system. The gasifier is of the modified Lurgi type developed by the British Gas Corporation. In comparison to the air-blown GCC power plant, the oxygen-blown fuel and power-generation processes are not as integrated, resulting in less system interaction and reduced difficulty of control. The turbine-lead control mode is the preferred strategy. Control of the combined-cycle is maintained close to that of a conventionally fueled combined cycle. The oxygen-blown system is more responsive than the air-blown system and can successfully meet power system requirements. 7 references, 12 figures, 1 table.

55380 (EPRI-AP—3121, pp 17.1-17.14) **Transportation and handling of medium-Btu gas in pipelines.** McCarrick, A.T.; Nguyen, P.N.; Sorensen, J.C. (Air Products and Chemicals, Inc., Allentown, PA). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Although medium-Btu gas (MBG) is toxic, MBG pipelines can be designed and built for a high level of safety. However, criteria more stringent in many areas than those used for natural gas pipelines should be employed. The safety level of each MBG pipeline is a function of its design, installation, routing, and operating plan. The design approaches suggested in this paper are aimed at preventing or mitigating pipeline failures during service. MBG's positive buoyancy in air tends to mitigate its hazardous effects should a leak or break occur. Carbon steel is adequate to transport treated MBG by pipeline if moisture and hydrogen sulfide are removed. 5 figures, 1 table. (SPH)

55381 (EPRI-AP—3121, pp 18.2-18.27) **Environmental characterization of the Texaco Coal-Gasification Process at Ruhrkohle/Ruhrchemie.** Magee, R.A.; Mann, R.M.; Hudak, C.E. (Radian Corp., Austin, TX). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

A series of tests was performed on the Texaco gasification process by the Electric Power Research Institute (EPRI), Radian, and the Tennessee Valley Authority (TVA) to determine the environmental impacts of a proposed coal-gasification plant in northern Alabama. Although TVA selected the Kopper-Totzek process for the plant, Radian and EPRI are completing the study. Results of the ecological and bioassay study to date are presented. 4 references, 4 figures, 9 tables. (DCK)

55382 (EPRI-AP—3121, pp 19.1-19.36) **Characterization of the Bi-Gas Selexol system and procedure development for gasification.** Kilpatrick, M.P.; Magee, R.A.; Williams, W.A.; Lewis, D.S. (Radian Corp., Austin, TX). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Results are presented from the sampling and on-site analyses conducted during April and May, 1982, at the Bi-Gas coal-gasification pilot plant in Homer City, Pennsylvania. Interim results of procedural development and verification efforts initiated on-site and furthered at Radian Corporation and the Battelle Laboratories in Columbus, Ohio are also summarized. Both data-collection and procedure development efforts presented are focused on the inlet, outlet, and acid-gas streams of the Selexol acid-gas-removal unit operated at the site. This work is being conducted by Radian Corporation with funding from the Electric Power Research Institute, the U.S. Environmental Protection Agency, and the US Department of Energy. 4 references, 9 figures, 7 tables.

55383 (EPRI-AP—3121, pp 11.1-11.51) **Transient-multidimensional computer simulation of Texaco-like coal-gasification reactors.** Schneyer, G.P.; Brownell, D.H. Jr.; Cook, J.L. (S-CUBED, La Jolla, CA). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

This paper concentrates on demonstrating the capabilities of the Electric Power Research Institute (EPRI) entrained flow (EEF) model in the form of calculational results. It contains a concise review of the characteristics and capabilities of the EEF model; a much-more-detailed description of the model is available in the Final Report (EPRI-RP—1037-2), which comprises the bulk of this paper and describes and reviews a set of three computer simulations of Texaco-like reactor configurations which, taken together, demonstrate virtually all of the capabilities of the EEF model. 5 references, 32 figures, 4 tables.

55384 (ORNL/TM—8508) **Corrosion coupon studies at coal liquefaction pilot plants.** Keiser, J.R.; Baylor, V.B.; Howell, M.; Newsome, J.F. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 47p. NTIS, PC A03/MF A01. Order Number DE84000291.

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As part of the Fossil Energy Materials Program at Oak Ridge National Laboratory, we have supplied corrosion coupons to coal-liquefaction pilot plants for exposure in selected vessels. These vessels were chosen on the basis of previous corrosion experience, anticipated corrosion behavior (especially important when operating conditions were changed), accessibility, and availability. Alloys exposed were selected to give a series with a corrosion resistance ranging from less than to greater than that thought to be needed for each application. Corrosion rates calculated from weight changes of the exposed coupons provide information useful in selecting materials for coal-liquefaction plants. The results presented are from coupons exposed in the Wilsonville, Alabama, and Fort Lewis, Washington, Solvent Refined Coal pilot plants; the Catlettsburg, Kentucky, H-Coal Pilot Plant; and the Baytown, Texas, Exxon Coal Liquefaction Pilot Plant.

55385 (ORNL/TM—8611) **ASPEN modeling of the Tri-State indirect-liquefaction process.** Barker, R.E.; Begovich, J.M.; Clinton, J.H.; Johnson, P.J. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 69p. NTIS, PC A04/MF A01. Order Number DE84000657.

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The ASPEN process simulator has been used to model an indirect-liquefaction flowsheet patterned after that of the Tri-State project. This flowsheet uses Lurgi moving-bed gasification with synthesis-gas conversion to methanol folowed by further processing to gasoline using the Mobil MTG process. Models developed in this study include the following: Lurgi gasifier, Texaco gasifier, synthesis gas cooling, Rectisol, methanol synthesis, methanol-to-gasoline, CO-shift, methanation, and naphtha hydrotreating. These models have been successfully developed in modular form so that they can be used to simulate a number of different flowsheets or process alternatives. Simulations of the Tri-State flowsheet have been made using two different coal-feed rates and two types of feed coal. The overall simulation model was adjusted to match the Tri-State flowsheet values for methanol, LPG, isobutane, and gasoline. As a result of this adjustment, the MTG reactor yield structure necessary to match the flowsheet product rates was determined. The models were exercised at different flow rates and were unaffected by such changes, demonstrating their range of operability. The use of Illinois No. 6 coal, with its lower ash content, resulted in slightly higher production rates of each of the products as compared to use of the Kentucky coal.

55386 (ORNL/TM—8624-Vol.2) **Health and environmental effects document on direct coal liquefaction - 1982. Volume 2. Appendices.** Walsh, P.J. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 323p. NTIS, PC A14/MF A01. Order Number DE84000634.

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Volume 2 consists of appendices as follows: (1) Exposure Assessment; Engineering Analysis of Process Source Terms, Exposure Source Terms, Atmospheric Transport, Terrestrial Food Chain Pathways, and Drinking Water and Aquatic Food Chain Pathways. (2) Health Effects Assessment: Human Level Studies, Relation Potency Factors from Animal Oncology, Cellular Level Studies, Bacterial Mutagenicity, Subcellular Indicator Data as Criteria for Chemical Toxicity, and Reproductive Effects. (3) Safety Risks of Coal Extraction and Transportation: Coal Extraction, and Coal Transportation. These subjects are treated in considerable detail. (LTN)

55387 (ORNL/TM—8708) **Effects of preheater residence time on the rheology of SRC-I slurries under preheater conditions. Final report.** Lee, D.D.; Sams, T.L. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE84000651.

Studies were made on SRC-I feed slurries under preheater conditions to determine the effects of residence times at or above 500 K on the rheological properties of the slurry. Measurements were taken at 17.3 MPa pressure, at reaction times from 15 to 120 s, and at temperatures from 450 to 644 K. Results show that an increase in residence time from 15 to 45 s results in a decrease in apparent viscosity by about 50% at 589 K. The experiments also revealed that after relatively short reaction times (2 min) without hydrogen pressure, the products exhibit fairly low viscosity. At reaction times less than 2 min, the viscosity changes rapidly with reaction time at the temperatures examined. The results demonstrate that rheological data under preheater conditions must be taken carefully at a constant residence time in order to avoid reaction-time effects as the shear rate is changed.

55388 (ORNL/TM—8757) **Program plan for development of hot dirty-gas heat exchangers for coal-gasification systems.** Churnetski, E.L. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 93p. NTIS, PC A05/MF A01. Order Number DE84000656.

This report deals with the heat exchanger applications, and its scope includes a broad range of gasification systems, such as the generic models for entrained-flow, moving-bed, and fluidized-bed gasifiers. The major application of hot dirty-gas heat exchangers is in the area of heat recovery for improved gasifier efficiency. The inlet temperature requirements for these heat exchangers varies from ~ 650 to ~ 1480°C (1200 to 2700°F) at an operating pressure of ~ 4.1 MPa (600 psi). A state-of-the-art industrial capabilities survey indicated that the gasification heat-recovery requirement could be met by the use of waterwalled radiant heat exchangers, quench systems, and convective tube banks. The waterwalled radiant heat exchangers and quench systems are employed for the high-temperature applications and the convective tube banks for the lower-temperature requirements. Based on operating experience in coal-gasification programs, the major difficulties encountered in the use of heat recovery systems are fouling and pressure and temperature limitations of present materials and designs. Radiant waterwall designs are susceptible to fouling from molten slag and high-temperature bonded deposits. The convective heat exchangers are also susceptible to high-temperature bonded deposits and, to a lesser extent, slag fouling. In-situ cleaning of these surfaces utilizing coal-fired power-plant experience results in dilution of the product stream and increased purification expense. A research and development program was developed for the demonstration of advanced heat exchangers and cleaning systems for gasification applications. The development efforts would include cleaning systems, fluidized-bed heat exchangers, packed-bed recuperators, direct-contact moving-ball heat exchangers, and tubular ceramic heat exchangers. 67 references, 3 figures, 1 table.

55389 (PNL—4836) **Comparison of in-vitro and in-vivo studies with coal liquids from the SRC-II process.** Mahlum, D.D.; Frazier, M.E.; Pelroy, R.A.; Renne, R.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 74p. NTIS, PC A04/MF A01. Order Number DE84000851.

Coal liquids obtained from the SRC-II process and fractions prepared from these liquids have been assayed in a number of in vivo and in vitro systems for biological activity. The in vitro systems includes: (1) the standard Ames Salmonella typhimurium reverse mutation assay, (2) the S. typhimurium fluctuation test; (3) forward mutation assay in S. typhimurium (8-Ag) test; (4) prophage induction (INDUCTEST); (5) Syrian hamster ovary (SHE) cell transformation assay; and (6) Chinese hamster ovary (CHO) cell mutation assay. In addition, both initiation/promotion (I/P) and chronic skin-painting assays were used as measures of tumorigenesis. In general, materials shown to be carcinogenic in the chronic skin-painting assay were also positive in the other assays. The failure of the Ames assay to respond to the neutral polycyclic aromatic hydrocarbon (PAH) fraction of SRC-II heavy distillate (HD) was a notable exception. Quantitatively, the Ames assay was more sensitive to nitrogen-containing compounds (particularly primary aromatic amines) and less sensitive to mixtures of PAH. The mammalian systems, both in vitro and in vivo, showed greater responses to the neutral PAH than to the nitrogen-containing compounds. Activity in all biological systems increased with increasing boiling point of the material tested. The I/P assay ranked the materials studied in the same order as did the chronic skin-painting assay; however, the results of the two assays diverged quantitatively, particularly for certain distillate cuts. Despite the lack of quantitative agreement between the in vitro microbial and in vivo skin-painting assays, the in vitro assays remain valuable screening tools for complex mixtures. Sufficient information now exists to qualify the use of the in vitro assays for complex mixtures and to increase their reliability.

55390 **(SAND—83-0534) Characterization of used catalysts from the Two-Stage Liquefaction process.** Stohl, F.V.; Thakur, D.S. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1983. Contract AC04-76DP00789. 37p. NTIS, PC A03/MF A01. Order Number DE84000986.

The objective of this work was to determine the changes which occurred in the catalyst during Two-Stage Liquefaction (TSL) process runs. The procedure consisted of characterizing the fresh catalyst and used catalyst samples from run 2LCF23, which showed severe deactivation, and comparing the results. This run used a 70/30 volume % ratio of Kerr-McGee deashed SRC-I from Kentucky No. 9 coal and prehydrogenated Koppers creosote oil. The catalyst was modified Shell 324 and the catalyst age attained during this 22 day run was ~ 400 lbs 850°F+/lb catalyst. Results of the catalyst analyses showed that the organic content of the second reactor catalyst was significantly higher than the first reactor catalyst (22 wt % versus 18 wt %), whereas the catalyst from the first reactor had a higher Fe + Ti content than the second (5.2 wt % versus 1.8 wt %). An analysis of the catalyst samples by scanning electron microscopy showed the presence of a pyrrhotite crust on the first reactor catalyst and showed that the iron and titanium contaminants were concentrated in the outer region of the catalyst pellets. The organic deposit appeared to have a greater effect than contaminant metals on the decrease in surface area of the used catalysts. Comparison of these results with previously reported TSL catalyst data shows that the high metals content in the sample from the first reactor and the high organic content of the second reactor catalyst are common occurrences in TSL runs. The presence of the pyrrhotite crust deposit may be a main cause of the severe catalyst deactivation in run 2LCF23.

55391 **Denitrogenation. Novel high-temperature reactions of N,N-dimethylaniline.** Stenberg, V.I.; Srinivas, V.R.; Baltisberger, R.J.; Woolsey, N.F. (Univ. of North Dakota, Grand Forks). *Journal of Organic Chemistry;* **48**: No. 7, 1107-1111(8 Apr 1983). Contract AC01-76ET10516.

Nitrogen removal studies are important for denitrogenation in petroleum and coal conversion technologies. N,N-Dimethylaniline was selected as an appropriate model for denitrogenation of aniline, pentylamine, indole, and carbazole moieties present in coal and petroleum because it contains two distinct C-N bond types. Heterocyclic compounds were found to be the major nitrogen-containing species in coal-derived products. Small amounts of nonheterocyclic compounds such as amines and nitriles are also present. In regard to denitrogenation of heavy crude oils and coal-derived liquids, the data demonstrate the rupture of the aromatic-nitrogen bond without first reducing the aromatic ring contrary to some current thinking.

55392 **Three-phase flow of flashing non-Newtonian coal slurry-gas mixtures through a conduit.** Khan, A.A.; Ott, L.J. (Oak Ridge National Lab., TN). *Annals of the New York Academy of Sciences;* **404**: 130-132(1983). (DOE/ER/12020—1; CONF-8206187—). Contract W-7405-ENG-26.

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

To develop design procedures for predictin pressure drops in conduits carrying three-phase flashing flows, a model has been developed at Oak Ridge National Laboratory (ORNL) that is based on the current state of the art. This model has been tailored to consider coal liquids with gases and solids present. The investigation has examined the fluid dynamics in the let-down valve area of a coal liquefaction plant by assuming a one-dimensional steady-state model. The coal liquids are modeled as a mixture of pseudocomponents in an approach similar to that used by the petroleum industry. Boiling points are chosen to characterize pseudocomponent fractions. Previous studies at ORNL have shown that, for a mixture of hydrogen gas, methane, and a coal-derived liquid, empirical correlations by Wilson and coworkers best predict critical pressures, temperatures, and acentric factors for the pseudocomponents. These properties are needed to perform flash calculations that use the Redlich-Kwong-Soave equation of state and a modified Grayson-Streed method. Reasonable agreement was found between experimental results and the theoretical flash calculations. Energy and mass balances used in the flash calculations interact with a momentum balance to obtain the pressure drop and gas-to-slurry ratio for each interval of length along the flow path. Since there is a possibility of choked flow at each interval of flow length, a calculation of critical flow velocity is also made.

0105 By-products

REFER ALSO TO CITATION(S) 55352

0106 Properties

REFER ALSO TO CITATION(S) 55367, 55390

55393 **(DOE/MC/19210—1466) Computed tomography of coals. Quarterly technical progress report No. 1, August 16, 1982-November 28, 1982.** Maylotte, D.H.; Kosky, P.G.; Spiro, C.L.; Lamby, E.J. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). 1982. Contract AC21-82MC19210. 13p. NTIS, PC A02/MF A01. Order Number DE83017041.

The purpose of this contract is to examine the utility and advantages of x-ray computed tomography (CT) for investigating the structure within coal and the changes that occur in these structures during such processes as combustion and gasification. The CT technique is noninvasive and nondestructive. It can produce interior views of the coal and, with a data acquisition time of ca 9 seconds, can be used for following many coal processes in real time. This is the first in-depth study of the application of the x-ray tomography technique to the problems in coal utilization, and consequently, considerable time will be spent in the early stages of this contract in examining CT pictures of coal and relating them to more conventional petrographic and mineral analyses. This phase of the work is being undertaken in Task 1 of the contract and is reported for this period. Building on this foundation, the succeeding tasks will follow changes in the coal structure during reaction. The first series of CT experiments is scheduled to take place on December 11-13, 1982, at the General Electric Company, Medical Systems Operation, Milwaukee, Wisconsin. 4 figures, 1 table.

55394 **(DOE/PC/30210—T4) Investigations of the changes in coal structure occurring during gasification. Final report.** Griffiths, P.R. (Ohio Univ., Athens (USA). Dept. of Chemistry). 23 Nov 1982. Contract FG22-80PC30210. 72p. NTIS, PC A04/MF A01. Order Number DE83010618.

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Techniques based on the use of diffuse reflectance Fourier transform infrared spectrometry for the study of reacting coals and heterogeneous catalysis are described in this report. The design of a cell permitting the temperature of the sample to be raised to 600°C and gas pressures to be varied between 10^{-6} and 10^{3} torr is reported. The effective resolution of spectra is enhanced by the use of Fourier self-deconvolution and a method of optimizing this process is described. The low temperature oxidation of coals of all ranks has been studied. The data indicate that the degree of aromaticity increases noticeably, even at 150°C, with some of the aromatic groups being formed by dehydrogenation of hydroaromatic methylene groups. At least eight different types of carbonyl groups are formed, of which anhydride groups appear in all spectra, especially of the higher rank coals. Thermosolvolysis of a high volatile bituminous coal at temperatures to 400°C is discussed. Several spectral changes can be correlated with events occurring near the plastic softening temperature. The adsorption of carbon monoxide on supported metal catalysts has been investigated as a function of catalyst pretreatment, adsorbate coverage and metal loading to illustrate the potential of diffuse reflectance infrared spectrometry for monitoring gas-solid reactions under a wide variety of temperatures and pressures. The feasibility of monitoring intermediates formed during the reaction of CO and H_2 appears to be indicated. 48 references, 36 figures, 1 table.

55395 **(LA-UR—83-2578) Applications of scanning electron microscopy to the study of mineral matter in peat.** Raymond, R. Jr.; Andrejko, M.J.; Bardin, S.W. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 17p. (CONF-8310170—1). NTIS, PC A02/MF A01. Order Number DE84001360.

From International symposium on peat utilization; Bemidji, MI, USA (11 Oct 1983).

Scanning electron microscopy (SEM) and energy dispersive spectrometry (EDS) have been used for in situ analysis of minerals in peats by combining methods for producing oriented microtome sections of peat with methods for critical point drying. The combined technique allows SEM analysis of the inorganic components and their associated botanical constituents, along with petrographic identification of the botanical constituents. In peat deposits with abundant fluvial- or marine-derived minerals, one may use the above technique and/or medium- or low-temperature ashing followed by x-ray diffraction to readily identify the various mineral components. However, in some freshwater environments the scarcity of non-silica minerals makes the above techniques impractical. By separating the inorganic residues from the peat, one can isolate the non-silica mineral matter in the SEM for analysis by EDS. Furthermore, such separation allows SEM analysis of features and textures of both silica and non-silica mineral particles that might otherwise be unidentifiable. Results indicate the occurrence of detritial minerals in both Okefenokee and Snuggedy Swamp peats, the presence of authigenic or diagenetic minerals growing within peats, and dissolution features on freshwater sponge spicules that may account for the absence of spicules in Tertiary lignites.

55396 (LMF—102, pp 3-9) **Summary of physicochemical characteristics of effluents from an experimental low BTU coal gasifier.** Newton, G.J.; Carpenter, R.L.; Henderson, R.F.; Hanson, R.L.; Benson, J.M. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Results of physicochemical characterization of process streams at the Morgantown Energy Technology Center's stirred-bed, Lurgi type, low Btu coal gasifier are summarized. Major portions of the data came from a sampling effort conducted in June 1981 and, to a lesser extent, from sampling in June 1982. Gaseous, liquid and solid process and waste streams were analyzed for physical and chemical characteristics relevant to assessment of inhalation hazards associated with this emerging energy technology.

55397 (LMF—102, pp 10-13) **Elemental analysis of coal gasification effluents by atomic absorpton spectroscopy.** Hanson, R.L. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The assessment of environmental consequences of coal gasification requires analysis of Environmental Protection Agency priority pollutant elements in the gasifier process stream and potential effluents and wastes. These analyses will aid in the evaluation of the effectiveness of product gas cleanup devices. We analyzed samples of Venturi scrubber water, process stream samples collected downstream from the cyclone and electrostatic precipitator and dust from the cyclone. We also analyzed aerosols collected from the process stream with an 8-stage high-temperature high-pressure cascade impactor. Lead, chromium and arsenic were present at greater than 1 ppM in the Venturi scrubber outlet water. Significantly higher concentrations were observed for sodium, potassium and chromium in the smaller particles compared to the larger particles collected by the high-temperature high-pressure cascade impactor.

55398 (LMF—102, pp 14-19) **Electron spectroscopy for chemical analysis, energy dispersive x-ray analysis and scanning electron microscopy of gasifier samples from a high-temperature high-pressure impactor.** Rothenberg, S.J.; Brundle, C.R.; Carpenter, R.L.; Newton, G.J.; DeNee, P.B.; Henderson, R.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A gasifier particulate sample obtained on stainless steel impactor plates in an impactor operated at 400°C, 8 to 9 atm pressure, has been examined by electron spectroscopy for chemical analysis (ESCA), energy dispersive x-ray analysis (EDXA) and scanning electron microscopy (SEM). The ESCA spectra of the samples were taken before and after ion etching and for the blank impactor plates. The SEM and EDXA were obtained for samples still on the plates and for samples removed from the plates and mounted on carbon stubs. The data indicated that a large portion of the particles was partially pyrolyzed coal.

55399 (LMF—102, pp 20-23) **Fractionation of the volatile components of environmental samples by vacuum line cryogenic distillation.** Dahl, A.R.; Benson, J.M.; Hanson, R.L.; Rothenberg, S.J. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A method for fractionating gases, volatile liquids and solids dissolved in complex chemical matrices of environmental origin has been investigated. The method, vacuum line cryogenic distillation, involves no solvents or columns and minimizes loss of thermally unstable components. Compounds detected on diesel particles by this method but not by other methods included NO/sub x/ species, 2-methylbutenal, methyloxirane and methoxymethylpropane. Similarly, C_3-C_7 hydrocarbons, among other compounds, were detected in coal gasifier tar. Vacuum line cryogenic distillation promises to be useful for analysis of a variety of environmental samples.

55400 (LMF—102, pp 24-26) **Physical and chemical characterization of large fluidized bed combustors.** Carpenter, R.L.; Cheng, Y.S.; Hanson, R.L.; Newton, G.J. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Sampling of two larger fluidized bed combustors (FBCs) has been carried out using sampling methodologies similar to that used on a small experimental FBC. Aerosol particle size and vapor phase hydrocarbon concentrations at the smokestack breech did not vary greatly but aerosol concentrations and extractable hydrocarbon concentrations in baghouse ash varied among the combustors.

0108 Waste Management

REFER ALSO TO CITATION(S) 55357, 55423, 55727, 55911

55401 **(AD-A—127636/9) Particulate air pollution control for Army coal-fired boiler plants. Final report.** Mikucki, W.J. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Mar 1983. 17p. (CERL-TR-N—140). NTIS, PC A02/MF A01.

The Army has several coal-fired boiler plants, and, in accordance with its Solid Fuel Conversion Program, will have many more in the future. Particulate emissions from such plants are strictly regulated by state agencies. The current coal-fired plants use various particulate-control technologies, with mixed success. This study examined these technologies and determined several design deficiencies which could contribute to the uneven performance of existing Army air pollution control devices. This study also identifies three new particulate control technologies with possible application to Army installations and industrial facilities, and gives recommendations for the operation and maintenance of the Army's existing technologies.

55402 **(BNL—51679) Resources from coal, coal wastes, and ash. Proceedings of a workshop.** Waide, C.H. (ed.). (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 169p. (CONF-8206173—). NTIS, PC A08/MF A01. Order Number DE83017775.

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

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The first objective of the workshop was to identify mineral resources available from wastes that result from coal preparation processes, from the combustion of coal (ash), from post-combustion of treatment wastes (such as flue gas cleanup) and wastes associated with the conversion of coal to liquids and gases. The second objective was to review current technologies for resource recovery from coal and coal related solid wastes. A third objective was to assess the potential for further development of such processes and establish R and D priorities. A final and more general objective was to provide the Department of Energy (DOE) with the considerations and conclusions of the many participants whose important capabilities led to their inclusion in the workshop. To accomplish this, the workshop brought together people from industry, universities, and government. Following the prepared presentations, the group divided into working groups which, through the use of preliminary questions, focused on various aspects of the topic. The results of their discussions were summarized by the Chairman at a final closing session. The working groups were arranged to deal with the topics shown below: coal and coal wastes as fuels and ores; coal ash as an ore; methods for resource recovery from coal, coal wastes, and ash - I; methods for resource recovery from coal, coal wastes, and ash - II; and industry viewpoints. Eight papers were entered individually into EDB and ERA. (LTN)

55403 (BNL—51679, pp 17-23) **An overview: resources from coal wastes and ash.** Burnet, G. (Iowa State Univ., Ames). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

The coal ash presentations first identify the minerals potentially available from the ash and then provide an overview of processing technology as it now stands. The latter is sufficiently well developed that rather precise economic feasibility studies have been conducted, and these are also discussed. We are looking forward to working with you and to receiving your assessment of the potential for what is proposed, and your recommendations for future research and development objectives and priorities.

55404 (BNL—51679, pp 133-167) **Working group summaries.** 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

In general, the results of the discussion groups were more pessimistic than some of the individual papers, emphasizing project risks, uncertain economics and competitive sources and prices of the recoverable metals. The first overall question discussed was whether there really is a need for resource recovery from coal wastes, and what is that need. If there is a need for resource recovery from coal wastes, then what is the role of government and what is the role of industry? It was conceded that (except for the magnetic separation, or production of magnetite) all of the methods which have been proposed for recovering material from ash or other coal wastes are high risk. They are speculative and in some sense long-term programs. There is a role for government in this kind of work. The government's role should be devoted principally to fundamental data collection and to testing process concepts. Government process development probably will only proceed to what we call the proof-of-concept stage. It is desirable to bring industry into process development as soon as possible. There is no reason why industry cannot get involved in the earlier, high risk, long-term work, but none of the people in our group felt that industry was likely to make a major commitment until the risks are reduced. The final questions and discussions involved where do we go from here. We recommend a moderately aggressive program in resource recovery; we should try to bring about coal waste process development within a reasonable amount of time. We recommend that DOE proceed with R and D to meet the additional requirements for increased coal use in the next few years. (LTN)

55405 **(CONF-8110292—) Symposium on gas cleanup.** (Gesellschaft zur Foerderung der Umwelt-Verfahrenstechnik an der Universitaet Essen e.V. (Germany, F.R.)). 20 Oct 1981. 118p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83770388.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

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At this symposium, the problems of dry and wet gas cleaning processes are treated and new investigations on this field are reported. The new energy technologies has resulted in interest of gas purification at higher temperatures of 700-1000°C. The seperate studies with filter, electrostatic precipitators and scrubbers, using melted salts and metals as washing medium, have shown the suitability of these apparatuses and processes for hot gas cleanup. One of the main aim of the research work was to reduce the energy demand of cleaning processes as much as possible. For this purpose, it is tried to find the optimum geometrical set-up and the optimum operational conditions of seperation devices like venturi scrubbers and electrostatic precipitators. Desulfurization by heterogenous gas-solid reactions and combined removal of SO_2 and NOsub(x) were the other topics of investigations. Further, it was determined that the results of particle size analysis with cascade impactors in industrial plants are not invariant. Separate abstracts were prepared for 8 papers in this book.

55406 (CONF-8110292—, pp 16p, Paper 1) **Heat gas cleanup by filtration.** Schulz, R. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

A filter is developed for dust removal at higher temperatures of 800-1000°C up to 1400°C, for the successful operation of gas turbines behind fluidized bed combustion and coal gasification processes. Filter mediums made of glas, alumina, alumina-silikat fibers are prepared in various forms and their suitability for hot gas filtration is tested in a laboratory set up. For each filter medium the following characteristics are determined: - Pressure drop as a function of free stream velocity. - Dust content of the clear gas as a function of free stream velocity. - Pressure drop as a function of dust charge and filtration time. - Creep behaviour by cleaning with continual pressure blow.

55407 (CONF-8110292—, pp 13p, Paper 2) **Hot gas cleanup by electrostatic precipitation.** Pape, H.G. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

The applicability of electrostatic precipitation for the purification of flue gas at a range of high temperature and pressure is investigated. First the suitability of the precipitator for cleaning the

gas is checked at 1000°C and 40 bar by static operation of precipitator with stagnant gas and without dust. Subsequently the efficiency of the precipitator is determined with continious filtering of dust under different geometrical and gas side conditions. Extensive removal of dust is achieved.

55408 (CONF-8110292—, pp 14p, Paper 3) **High-temperature gas purification with melted salts and metals.** Schuermann, B. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

By the method of wet scrubbing, the simultaneous removal of dust and hazardous gas components at high temperatures is studied, using melted salts and metals as a wash medium. By means of investigations using a semiindustrial set-up beside melted tin, in the first instance the melts of natrium and kalium hydroxide are used. By the simultaneous removal of dust and sulphur dioxide the degree of separation is determined as a function of gas velocity. A higher degree of purification is reached than at a temperature of 20°C.

55409 (CONF-8110292—, pp 12p, Paper 4) **Problems of the dry desulfurization.** Huebner, K. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

Methods of dry removal of sulfur dioxide and hydrogen sulfide, especially heteregeneous gas-solid reactions with calcium compounds are discussed. Accounts are given about the experiments of SO_2-removal, performed with calcium compounds using fest and fluidized bed laboratory scale reactors at temperatures below 400°C.

55410 (CONF-8110292—, pp 16p, Paper 6) **Combined removal of SO_2 and NO/sub x/.** Heiting, B. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

The simultaneous removal of sulphur dioxide, nitrogen oxides and fine dust is examined using loosely installed scrubbers. Extensive NO-absorbtion measurements with various wash mediums are performed in order to optimize a suitable absorption liquid. By using selectiv Iron(II)-complex salt solutions the part removal of NOsub(x) and the sufficient removal of SO_2 is achieved. A far-reaching precipitation of fine dust was attainable at high gas velocities.

55411 (CONF-8110292—, pp 12p, Paper 8) **Removal of flue dust.** Wiggers, H. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

For the investigation of higher quality dust seperators in respect of particle size specific seperation, measurements are performed with the fabric filter of a bituminous coal fired power station. Furthermore, experiments are carried out using a laboratory scale electrostatic precipitator and using a pilot precipitator in a coal fired power plant, in order to study the effect of changes in precipitator set-up on the removal of the flue dust. It is determined that, with the enlargement of channel widths, which were conventional so far, substantional advantages can be obtained.

55412 (DOE/MC/14004—T1) **Activities related to the development of a flue-gas-desulfurization chemical data base. Final report.** Garvin, D.; Huie, R.E. (National Bureau of Standards, Washington, DC (USA)). 14 Apr 1983. Contract AI22-80MC14004. 18p. NTIS, PC A02/MF A01. Order Number DE84000198.

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Thermodynamic and chemical kinetic data compilation and experimental measurements have been carried out on topics related to flue gas desulfurization. A summary of these activities is given in this report. A report has been issued that contains a data base of values of thermochemical properties of appropriate species, and measurements have been made of the osmotic coefficients of sodium and potassium carbonate. A bibliography has been prepared on the kinetics of sulfite oxidation and measurements have been made on the oxidation of sulfite in the presence of trace metals and also under photo-oxidizing conditions.

55413 (NBSIR—81-2345) **Report on some thermodynamic data for desulfurization processes.** Parker, V.B.; Staples, B.R.; Jobe, T.L. Jr.; Neumann, D.B. (National Bureau of Standards, Washington, DC (USA). Center for Chemical Physics). Sep 1981. Contract AI22-80MC14004. 90p. NTIS, PC A05/MF A01. Order Number DE84000505.

Tables are presented here of values of thermochemical properties and processes at 298.15°K for some substances of interest to DOE for flue-gas desulfurization. The substances covered are: (1) the aqueous ions: OH^-, SO_3^{-2}, HSO_3^-, SO_4^{-2}, HSO_4^-, CO_3^{-2}, HCO_3^-, H^+, Mn^{+2}, Fe^{+2}, Mg^{+2}, Ca^{+2}, Na^+, and K^+, and (2) solid, liquid, aqueous, and gaseous compounds or species formed from these ions. The tables contain the following: (1) the thermochemical property values, enthalpy of formation, Δ/sub f/H°, Gibbs energy of formation, Δ/sub f/G°, entropy, S°, and heat capacity, C/sub p/° all at 298.15°K, as well as the enthalpy difference between 298.15 K and O°K, H°-H°$_0$, for the basic species cited above, (2) the predicted values for ΔH°, ΔG°, ΔS°, and ΔC°/sub p/ as well as log K (equilibrium constant) for the processes, or reactions, of importance to DOE, calculated from (1), and (3) the property values, phi/sub L/, the relative apparent molar enthalpy, γ/sub +-/, the mean ionic activity coefficient, and phi, the osmotic coefficient, for the binary aqueous systems at 298.15°K, all as a function of concentration. Some documentation for (2) and (3) is provided. All of the values given are consistent with the NBS TN 270 Series.

55414 (PB—83-199166) **Economic evaluation of power plant ash use and disposal in Maryland.** Hudson, J.F.; Hunsberger, M.; Demeter, C.P.; Klose, P.N. (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). 1983. 155p. NTIS, PC A08/MF A01.

Electric utilities in Maryland generate about one million tons of coal ash per year, almost all of which is disposed of in landfills. With construction of new coal-fired units and conversion of existing units from oil to gas, this quantity will increase to over 3.4 million tons per year by 2000. This report examines the potential in Maryland for marketing coal fly ash and bottom ash as an alternative to disposal in increasingly scarce landfills.

55415 (PB—83-201889) **Fly ash pelletization. Final report 30 Sep 79-31 Dec 81.** Fuerstenau, D.W.; Mehrotra, V.P. (California Mining and Mineral Resources Research Inst., Berkeley (USA)). Jun 1982. 77p. NTIS, PC A05/MF A01.

The use of pulverized coal for power generation results in the production of vast amounts of fly ash in the United States. This research project has been concerned with the role of the physicochemical characteristics of fly ash in governing its pelletization and the strength of the product pellets in relation to their potential use as lightweight aggregate. The potential impact of this research is extremely great in that a severe environmental problem may be alleviated by converting a huge mineral waste into a resource.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 55357, 55381, 55386, 55397, 55400, 55830, 55831, 55832, 55833

55416 (CONF-8308124—1) **Calibration of laboratory bioassays with results from microcosms and ponds.** Giddings, J.M.; Franco, P.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 33p. NTIS, PC A03/MF A01. Order Number DE83017224.

From Symposium on validation and predictability of lab methods for the assessment of effects on environmental contaminants in aquatic ecosystems; Grand Forks, ND, USA (8 Aug 1983).

Effects of an organic contaminant (a synthetic coal-derived crude oil) were measured in outdoor ponds and indoor pond-derived microcosms and compared with results of laboratory bioassays. Ponds and microcosms were treated with the oil continuously

for 8 weeks. Concentrations of phenolic compounds (the major water-soluble constituents of the oil) spanned the range of acute and chronic toxicity concentrations determined in single-species bioassays. Effects were similar in microcosms and ponds, implying that microcosms are suitable models for field studies for some purposes. Significant changes in community metabolism and zooplankton populations occurred in microcosms and ponds exposed to less than 0.05 mg/litre phenols, near the 28-day Lowest Observed Effect Concentration for Daphnia magna. Ponds and microcosms were seriously damaged at concentrations near acute bioassay LC50 values. Indirect effects in the ecosystems occurred at all treatment levels, and included changes in water quality, replacement of sensitive taxa by more tolerant competitors, and changes in abundance of some species because of increases or decreases in their predators or grazers. The safe exposure level determined from the ecosystem experiments were accurately predicted by an application factor of 0.03 in conjunction with the most sensitive acute bioassay result (the D. magna 48-h LC50). Less conservative extrapolation methods overestimated the safe concentration of this material in these ecosystems. 28 references, 3 figures, 5 tables.

55417 (LMF—102, pp 480-484) **Health hazards due to toxicants in solid fluidized bed combustor waste.** Seiler, F.A.; Hobbs, C.H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Potential health hazards due to the deposition of solid FBC waste in the environment are analyzed. Worst case estimates for trace element incorporation were made for the drinking water pathway and for a more general mode of environmental transport which encompasses most of the terrestrial and aquatic ecosystems. Health effects other than the induction of cancer were not addressed due to the lack of quantitative information at low doses. Based on present knowledge, solid FBC waste, properly disposed of, is not expected to pose significant health hazards for man.

0110 Reserves And Exploration

55418 (USGS-BULL—1526) **Coal geology of Adams, Blaine, Richardson, and Sitka quadrangles, Kentucky, and Louisa quadrangle, Kentucky-West Virginia.** Hayes, P.T.; Connor, C.W. (Geological Survey, Washington, DC (USA)). 1982. 73p. GPO.

The report area, a part of the Appalachian Plateau physiographic province, contains outcropping rocks of the Lee, Breathitt, Conemaugh, and Monogahela Formations of Pennsylvanian age. A total of about 370 million short tone (336 million tons) of demonstrated and inferred coal resources in 18 coal beds or zones underlie the area. Three of these units, the Van Lear coal bed and the Peach Orchard and Richardson coal zones, contain more resources and have produced more coal than the other 15 beds or zones combined, though 7 other beds or zones are of local importance. Thirty samples of coal from 14 beds were subjected to standard coal analysis, and 45 samples of coal were subjected to trace-element analysis. The standard analyses indicate that most of the coal in the area is of high-volatile B or A bituminous rank but that some is high-volatile C bituminous in rank. The indicated sulfur content of several of the coals is less than 1 percent but several others have sulfur contents in the 2 to 5 percent range. Some geographic and stratigraphic variations of certain trace elements within the coals are noted.

0120 Mining

REFER ALSO TO CITATION(S) 55461

55419 (CONF-8210168—, pp 115-122) **UMWA perspective on Illinois mining.** Holland, M.H. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The United Mine Workers of America (UMWA), the nation's largest energy-producing labor union, recognizes that environmental decisions affect jobs, but does not want business interests to create an imbalance. The union's review of S. 1706 to amend the Clean Air Act finds the jobs and revenues that will be lost directly or indirectly from proposed acid-rain-control strategies to be unacceptable. UMWA supports retention of Section III of the Clean Air Act, however, and objects to any weakening of the existing laws. How Congress deals with these proposals could determine the economic future of the Illinois coal industry. (DCK)

55420 (MSHA/IR—1101) **Guide to geologic features affecting coal-mine roof.** Stahl, R.L. (Mine Safety and Health Administration, Denver, CO (USA). Denver Technical Support Center). 1979. 21p. NTIS, PC A02/MF A01. Order Number DE83902831.

Geologic features including concretions, clay veins, faults, fossils, channel sandstones, and rolls (all defined in the appendix) can signal hazardous roof conditions in underground coal mines. This guide is designed to be used by mine personnel as a quick reference to aid in recognizing these geologic hazards. If a geologic hazard is recognized in time appropriate corrective measures can be taken, thus reducing the likelihood of roof fall accidents and injuries. Visual inspection is an important aspect of roof control. This guide is designed to be used by mine personnel as a quick reference to aid in recognizing geologic hazards encountered in underground coal mining operations. If a hazard can be recognized and reported in time, appropriate roof control measures can be taken, thus reducing the likelihood of roof fall accidents and injuries.

55421 (MSHA/IR—1134) **Injury experience in stone mining, 1980.** (Mine Safety and Health Administration, Denver, CO (USA). Health and Safety Analysis Center). 1981. 403p. NTIS MF A01. Order Number DE83902954.

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This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of stone mining in the United States for 1980. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injuried, nature of injury, occupation, and principal kind of stone. Correlative information on employment, worktime, and operating activity also is presented. For ease of correlation with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of the report. Occurrences identified as occupational illnesses by miner operators were reported to MSHA and were processed in accordance with 30 CFR Part 50.20-6. The reported illnesses are summarized in seven categories for each work location, kind of stone, and state. Incidence rates and severity measures are not computed for occupational illnesses.

55422 (NP—3902704) **Annual report and achievments: Fiscal Year 1978. Part 1.** (Mine Safety and Health Administration, Arlington, VA (USA)). 28 Mar 1980. 87p. NTIS, PC A95/MF A01. Order Number DE83902704.

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For employees of the Mine Safety and Health Administration, the 1978 fiscal year, which covered most of the first year following enactment of the far-reaching Federal Mine Safety and Health Act of 1977, was a period of challenge, change and rededication to the agency's mission of reducing deaths, injuries and illnesses in the Nation's mines. As the year ended on September 30, 1978, it could be said both that promising beginnings had been made in embarking on important new courses under the 1977 Act and that a good deal more remained to be done to assure that all miners can fulfill their vital roles in meeting national energy and mineral needs at no cost to their safety or health. In the ensuing months of 1978 and early 1979, a number of additional difficult tasks required to implement the Act had been completed or were under way. The Federal Mine Safety and Health Act was enacted on November 9, 1977, and took effect on March 9, 1978. At that time, the Mining Enforcement and Safety Administration (MESA) was transferred from the Department of the Interior to the Department of Labor and renamed Mine Safety and Health Administration (MSHA). Under the 1977 Act, the rights and entitlements of miners were significantly expanded. The Act provided that a miner or representative of miners be allowed to accompany an MSHA inspector during a mine inspection and attend any pre- or post-inspec-

tion conferences at full pay for time spent in such activities. Miners' rights to have inspections made at their request were increased. The Act provided that miners were to be paid during periods in which a mine or part of a mine is closed because of a withdrawal order.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 55380, 55961, 56227

55423 **(ANL/ECT-TM—7) Impact of coal cleaning as a sulfur-reduction strategy in the Midwest.** Doctor, R.D.; Anderson, J.L.; Garvey, D.B.; Livengood, C.D.; Farber, P.S. (Argonne National Lab., IL (USA)). Jun 1983. Contract W-31-109-ENG-38. 117p. (EPA—905/2-83-001). NTIS, PC A06/MF A01. Order Number DE84000523.

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The potential for reduction of sulfur dioxide emissions through coal cleaning is examined for electric-utility power plants in the Ohio, Indiana, and Illinois region. Twenty-four plants burning predominantly high-sulfur coal and having capacities of 500 MWe or greater are identified, and the characteristics of their coal supplies are analyzed. The sulfur reductions attainable via coal cleaning for the various coals are estimated, and the costs are compared with those for equivalent sulfur dioxide reductions using flue-gas desulfurization. Coal cleaning is shown to be a cost-effective option for approximately half of the plants studied, although the total sulfur dioxide reduction potential is much less than for flue-gas desulfurization. Regulatory and institutional considerations relevant to mandatory coal-cleaning requirements are evaluated, as are options for encouraging greater voluntary use of cleaned coal. Actions at the state level to promote greater use of cleaned coal are found to be most likely. 20 references, 14 figures, 17 tables.

55424 (BNL—51679, pp 59-65) **Physical coal cleaning and ore dressing: a comparison.** Hilleke, A.F. (Univ. of Alabama, University). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

When comparing systems related to coal preparation and mineral dressing, one must consider recirculating loads, referred to earlier as middlings. In the mineral industry where the gangue and valuable mineral are physically locked in relatively fine grains, considerable grinding is necessary to liberate the constituents so that a separation can be made. Because of an inadequate liberation of the constituents in a portion of the ore being processed, this portion becomes a recirculating load for further grinding to approach complete liberation. These recirculating loads can be 300 or 400 percent of the system feed. In coal preparation the valuable mineral constituents, carbon and hydrocarbon compounds, are in relatively coarse pieces as is the refuse material. Therefore, fine crushing and grinding are not practiced to any major degree in the industry. The physically interlocked particles of coal and refuse contained in the system feed are generally either rejected in the plant refuse, recovered with the clean coal, recovered separately as a low quality steam coal product or divided evenly between clean coal and refuse. The auxiliary equipment used in both processing disciplines is similar, that is, vibrating screens, hydrocyclones, filters, thickeners, certain types of classifiers and Hydro-separators. However, crushing and grinding equipment are quite different. Ball and/or rod mills are very rarely if ever used in processing coal and the old standby rotary breaker is rarely if ever used in mineral dressing.

55425 (BNL—51679, pp 66-75) **Chemical coal cleaning.** Hart, W.D. (TRW Systems, Redondo Beach, CA). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

The compelling reason for chemical coal cleaning as well as physical coal cleaning is the EPA new source performance standards which require up to 90% reduction of sulfur dioxides. The principal sulfide is pyrite which occurs in coal pores and as discrete occlusions. These are cleaned to the degree possible by physical cleaning methods. Early chemical cleaning along with the described physical cleaning methods, could meet the more stringent requirements of the EPA. The great contributor to this problem is the organic sulfur. Principally, organic sulfur is contained in the coal matrix, either as thiols, mercaptans, sulfides, or disulfides, or it may occur in an aromatic ring structure such as thiophene. This sulfur can only be removed by breaking chemical bonds, since it is a portion of the coal chemical matrix. The DOE has sponsored or is sponsoring five leading chemical coal cleaning processes: TRW Fused Caustic Leach (Gravimelt), GE Initial Dry (Caustic) Then H_2O Leach, JPL Chlorinolysis - Aqueous Leach, Ames Super Clean, and the Battelle Aqua-Refined process. All of the chemical processes remove ~ 90% of the pyritic sulfur, and varying amounts of organic sulfur. With respect to meeting clean air standards, GE microwave and TRW Gravimelt give the best results. A comparison of these two processes as well as the GE Process is given in Table 2. Ames and Battelle processes remove up to 25% and 40% organic sulfur, respectively, as well as 90% of the pyritic sulfur. Each of the above described processes have reached the benchscale demonstration phase. In addition to organic sulfur removal, the TRW Gravimelt process removes up to 99% of the ash, as shown in Table 3 for Pittsburgh, Kentucky, and Illinois coals.

55426 (CONF-8210168—, pp 123-126) **Marketing and transporting Illinois Basin coal.** Haug, G.F. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The Illinois Central Gulf Railroad (ICG) is analyzing, by country, the world market potential for Illinois Basin coal, with rail transport serving as the mine-mouth to ship-berth link. Because sulfur content is only one of several specifications, the ICG is finding an international market for Illinois coal. (DCK)

55427 **(DOE/EIA—0125(83/2Q)) Coal distribution, January-June 1983.** McNair, M.B. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Sep 1983. 117p. NTIS, PC A06/MF A01 - GPO. Order Number DE84001281.

This report continues the quarterly series on coal distribution started in 1957 by the Bureau of Mines, Department of the Interior, as a Mineral Industry Survey, Distribution of Bituminous Coal and Lignite Shipments. The last Bureau of Mines publication in this continuing series covered data for January-March 1977. The publications provide volume data on coal distribution by coal producing district, consumer use, and method of transportation. The reports are widely distributed to Federal and State agencies, the coal industry, and the general public. All data for 1983 in this report are preliminary. Data for 1979-1982 are final.

55428 **(DOE/EIA—0401) Coal Supply and Transportation Model: model description and data documentation.** (Science Applications, Inc., Wayne, PA (USA)). Aug 1983. Contract AC05-81OR20837. 205p. NTIS, PC A10/MF A01 GPO. Order Number DE83018179.

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This document is one of two volumes describing the March 1983 version of the Coal Supply and Transportation Model (CSTM), which is maintained by the Data Analysis and Forecasting Branch, Coal Division, Office of Coal, Nuclear, Electric and Alternative Fuels, Energy Information Administration. The volume comprises three chapters: an overview of the structure and operation of the model; a description of each model component and of the solution algorithm; and a description of the model input data.

55429 **(ORNL/TM—8882) Assessment of the technology of coal preparation.** Moyers, J.C. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 54p. NTIS, PC A04/MF A01. Order Number DE84000660.

The preparation of coal, wherein run-of-mine coal is processed to lower the ash and sulfur content, is an increasingly important part of the coal energy cycle. This assessment of the technology of coal preparation was undertaken to provide a better understanding of the extent and present practices of the preparation industry and to identify research and development needed for more-effective beneficiation of coal. Processes used to prepare the differ-

ent-size fractions of coal are described briefly and the performance of each of these processes is compared to that of an ideal process. The most-pressing research and development needs are in the areas of fine-coal (< 0.6 mm) cleaning and improved instrumentation and control. 39 references, 12 figures, 11 tables.

55430 **(ORNL/TM—8907) Damp-coal screening: effect of screen size and coal surface moisture on fines-removal efficiency.** Brantley, V.R.; Thomas, W.A. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 37p. NTIS, PC A03/MF A01. Order Number DE84000298.

The efficiency of fines (-28 mesh) removal over a range of screen openings and surface moistures was determined for a western Kentucky coal. Three test series were conducted, two at manufacturers' test sites and one at the Oak Ridge National Laboratory (ORNL). Wet and dry sieve analyses were performed on products from three exploratory tests at ORNL to evaluate the suitability of each method for the purposes of this investigation. While wet sieve analyses consistently produced a higher percentage of fines than did the dry sieve analyses, approximately the same screen underflow efficiency was calculated for each test with wet sieve and dry sieve data. Dry sieve analyses were therefore judged to be suitable for the screening performance evaluations. Graphs depicting the efficiency of fines removal as a function of screen opening and surface moisture were plotted for each test series. Graphs were also prepared which show the ratio of total underflow to fines in the underflow, here called underflow burden, as a function of screen opening and surface moisture. For a given screen opening, efficiency of fines removal decreases as surface moisture increases; underflow burden generally increases as surface moisture increases. For a given surface moisture level, both fines removal efficiency and underflow burden decrease as screen opening decreases. For a fixed fines removal efficiency, underflow burden increases as surface moisture level increases due to the larger screen opening required. 6 figures, 13 tables.

0140 Combustion

REFER ALSO TO CITATION(S) 55353, 56227, 56240

55431 (BNL—51679, pp 24-42) **Clean coal-water fuel: a triple edged sword.** Marnell, P. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

This paper gives a review of government policies on minerals and metals and includes a table of US net import balance of minerals and metals as a percentage of apparent consumption for 1977 to 1980, including the foreign sources. Briefly, it discusses the deteriorating financial status of the US minerals industry. Then it lists the solid waste production in the US. Next, while we use too much oil and natural gas, there are a number of constraints on retrofitting boilers to use coal. Then it discusses the author's preferred solution: the use of coal-water slurries (he prefers a 60/40 coal-water mixture, which can be handled with out additives by stirring or air jets) and suggests possible problems may develop with the 70-30 mixtures some companies are trying. He reports on demonstration projects carried out in the USSR, FRG, and USA, emphasizing the possibility of minerals recovery due to the small particle size necessary. (LTN)

55432 **(DOE/ET/17093—1478) Testing and verification of granular-bed filters for the removal of particulate and alkalis. Eleventh quarterly project report, April 1, 1983-June 30, 1983.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1983. Contract AC21-80ET17093. 31p. NTIS, PC A03/MF A01. Order Number DE84000445.

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The Westinghouse Electric Corporation with Ducon, Inc. and Burns and Roe, Inc. are conducting a test and evaluation program of a Granular-Bed Filter (GBF) for gas-cleaning applications in pressurized fluidized-bed combustion processes. This work is funded by DOE PRDA for Exploratory Research, Development, Testing and Evaluation of Systems or Devices for Hot Gas Clean-up. This report describes the status of the testing of the subpilot scale GBF unit under simulated Pressurized Fluidized-Bed Combustion (PFBC) conditions through Phase IV and the design of a bench-scale, single-bed cylindrical element that will be utilized in Test Phase V.

55433 **(DOE/PC/30294—8) Pulverized fuel combustion: modeling and scaleup methodologies. Final report, October 1981-January 1983.** (Physical Sciences, Inc., Andover, MA (USA)). Jun 1983. Contract AC22-80PC30294. 151p. (PSI-TR—363). NTIS, PC A08/MF A01. Order Number DE83017562.

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A model for pulverized-fuel combustion in axi-symmetric geometry is described. The model describes the flow as quasi-one-dimensional with mixing between well-mixed regions. These regions include recirculation and primary and secondary flows. The model utilized detailed finite-rate chemical kinetics of pyrolysis, heterogeneous-char chemistry and gas-phase chemistry. Effects of particle-size distributions are included. Comparisons with IJmuiden furnace data are shown. 21 references, 39 figures, 9 tables.

55434 (EPRI-AP—3121, pp 15.1-15.39) **Combustion and gasification kinetics of chars from four commercially significant coals of varying rank.** Goetz, G.J.; Nsakala, N.Y.; Patel, R.L.; Lao, T.C. (Combustion Engineering, Inc., Windsor, CT). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

The combustion and gasification kinetics of size-graded coal chars were determined experimentally in Combustion Engineering's Drop Tube Furnace System (DTFS) under a program cosponsored by the Electric Power Research Institute. The chars were prepared in the DTFS from four commercially significant coals representing a wide range of rank; these included a Pittsburgh No. 8 high-volatile A bituminous coal, an Illinois No. 6 high-volatile C bituminous coal, a Wyoming Wyodak subbituminous C coal, and a Texas Monticello lignite. Additionally, a number of standard ASTM and special bench-scale tests were performed on the parent coals and chars prepared therefrom to determine their physico-chemical characteristics. Results showed that lower-rank coal chars were more reactive than higher-rank coal chars and that combustion reactions were much faster than gasification reactions. The activation energies were in the 17 to 20 kcal/mole range for combustion and 39.5 to 56 kcal/mole range for gasification. Temperature and reactant-gas partial pressure had a significant influence on char combustion and/or gasification, and particle size had a smaller but discernible influence on char combustion and/or gasification, and particle size had a smaller but discernible influence on char gasification. Char reactivities were closely related to their pore structure. Chars with higher surface areas were more reactive than chars with lower surface areas. Mathematical modeling of char combustion and gasification in the DTFS supported the experimental findings. 10 references, 20 figures, 5 tables.

55435 (EPRI-AP—3121, pp 16.1-16.18) **Coal thermal processing for low-sulfur, solid, utility boiler-fuel production.** Alvin, M.A.; Newby, R.A.; Archer, D.H. (Westinghouse Electric Corp., Pittsburgh, PA). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Electric utilities are interested in obtaining a low-cost, low-sulfur, coal-derived solid-fuel char for firing a conventional boiler. The concept behind this study was that a low-sulfur char material can be formed under specific pyrolysis, hydropyrolysis, gasification, or oxidation conditions at moderate temperatures (300 to 800°C), pressures (1 to a maximum of 10 atm), and various gas-contacting times, maintaining a high percent of the heating value of the coal feed in the char product. Forty-five bench-scale, fixed-bed tests were conducted at various temperatures to demonstrate the effectiveness of a gas-sequencing approach in the desulfurization of -20 +40 mesh Illinois No. 6 coal. Maximum desulfurization was

achieved at levels of 50 to 60% release of the initial sulfur content. Data on sulfur partitioning in the char indicated that the removal of pyrite is easily achieved under most pyrolysis conditions; the release of inorganic nonpyritic and of organic sulfur, however, is less certain. Pyritic sulfur was shown to be effectively removed from coal at high temperature, 600°C, by a variety of atmospheres, or at lower temperature, 450°C, by a combination of a reducing or inert atmosphere followed by an oxidizing atmosphere. Steam was demonstrated as the only contacting gas that released significant quantities of organic and sulfidic sulfur at temperatures of 500°C and at atmospheric pressure. Progressive tests carried out in this program have been effective in pointing out new directions for a process to produce low-sulfur char, but continued effort is required to identify the temperature and contacting sequence that maximizes the desulfurization of coal while maintaining the heating value of the char product. 3 references, 7 figures, 7 tables.

55436 **(ORNL/TM—8604) Combustion kinetics of Western Kentucky No. 9 coal.** Daw, C.S.; Krishnan, R.P. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 60p. NTIS, PC A04/MF A01. Order Number DE84000615.

The combustion kinetics of Western Kentucky No. 9 coal were measured in a tubular-flow reactor. The primary objective was to develop a kinetic expression suitable for calculating the combustion rate of devolatilized char in an atmospheric fluidized bed combustor. Coal particles ranging from about 0.64 to 0.033 cm (0.25 to 0.013 in.) in diameter were devolatilized and burned in oxygen/nitrogen mixtures at reactor temperatures between 866 and 1090°K (1100 and 1500°F) and at oxygen partial pressures between 0 and 0.21 atmospheres. Experiments with subliming naphthalene provided data for correlating the mass transfer between particles suspended in the reactor and the bulk gas stream. This correlation was then combined with the combustion data to separate the two primary rate components: external oxygen diffusion and intra-particle diffusion/reaction. The experimental results demonstrate that combustion of particles of about 0.64 cm (0.25 in.) in diameter is almost completely dominated by external diffusion. As particle size is reduced, intra-particle processes rapidly become more important. At sizes less than 0.1 cm (0.04 in.), intraparticle diffusion/reaction is clearly the rate determining step. The intrinsic diffusion/reaction rate (based on external surface area) was found to have an apparent order of 0.6 in oxygen and an effective activation energy of 11,500 cal/g-mole. It is hypothesized that the unusually low activation energy results from the effect of heating rate on internal surface area and/or catalysis due to inorganic impurities in the char. There is also evidence that the intra-particle resistance to diffusion is very low, allowign a high degree of internal burning. This is shown to result in a diameter dependent term in the intrinsic reaction rate expression. 21 references, 12 figures, 6 tables.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 55423, 55426, 55427, 55428

55437 (CONF-8210168—, pp 127-130) **Coal: opportunities and constraints.** Bond, C.E. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

As the nation's fifth largest coal-producing state, Illinois has large, well-staffed companies, a high-Btu product, abundant water resources, and over 30 billion tons of coal that can be recovered through existing technology. Increasing regulations to improve mine safety and reduce pollution make it difficult to remain competitive, however. The industry opposes a coal-severance tax in order to protect its markets. (DCK)

55438 (CONF-8210168—, pp 131-134) **Capital markets, finance, and Illinois coal.** Wilson, W. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

There are no changes in the ground rules for financing new coal projects, and the coal industry is not signficantly affected by the availability of capital markets since the conditions, for prudent investment remain the same. The economic downturn has forced some companies to scramble for new and different markets, and the industry is thus healthier than it otherwise might have been. The industry is affected most, however, when prompt and adequate rate relief is denied to electric utilities. (DCK)

55439 **(DOE/EIA—0427) National coal model: user manual.** (Computer Data Systems, Inc., Bethesda, MD (USA)). Sep 1983. Contract AC01-82EI11857. 111p. NTIS, PC A06/MF A01 - GPO. Order Number DE84000248.

This manual provides a functional guide for users of the National Coal Model (NCM) System to access the model, select appropriate input files, and obtain the desired output reports. The following information is presented: an overview of the NCM system, a description of the system files, description and usage of keys and overrides, and procedures for using the run-stream generator. The manual also contains a terminal operator's guide in Appendix A that describes how to access the EIA computer and log-on to TSO and SUPERWYLBUR. Sample output reports are included in Appendix B. The names, addresses, and telephone numbers of personnel to call for assistance are given in this chapter. These references are provided in case problems arise that cannot be resolved using this manual.

55440 **(DOE/EIA—0428) National Coal Model: model description and formulation.** Lancaster, M.A. (Kilkeary, Scott and Associates, Inc., Arlington, VA (USA); Computer Data Systems, Inc., Bethesda, MD (USA)). Sep 1983. Contract AC01-82EI11857. 71p. NTIS, PC A04/MF A01 - GPO. Order Number DE84000247.

This description of Version 5 of the National Coal Model emphasizes the representation of the coal and electric utility industries employed in the model. It also provides an explicit statement of the linear programming formulation of the NCM and the row and column structure of the NCM. The description is addressed to the researcher trained in economics, mathematical modeling, or operations research. It is intended to provide an understanding of the economic and engineering assumptions underlying the structure of the model and the data.

0160 Health And Safety

REFER ALSO TO CITATION(S) 55386, 55420, 56478, 56479, 56480

55441 **(PNL-SA—10966) Teratologic studies of solvent-refined-coal-process materials.** Hackett, P.L.; Sikov, M.R.; Springer, D.L.; Mahlum, D.D.; Kelman, B.J. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 7p. (CONF-8308109—2). NTIS, PC A02/MF A01. Order Number DE84000119.

From 3. international congress on toxicology; San Diego, CA, USA (28 Aug 1983).

The most striking effects observed following intragastric or inhalation exposure of pregnant rats to SRC materials were related to the fetal lungs: a dose-dependent decrease in weight and an increased incidence of small lungs. Whether the SRC materials was heavy distillate or a process development unit material (HPS) did not appear to influence fetal effects, but higher-boiling-range materials induced fetal responses at lower doses. The most sensitive period for production of small lungs and cleft palate was from 12 through 14 days gestation.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 55422, 55437

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 55453

0202 Geology And Exploration

55442 (NP—3770373) Deposits and importance of terpenoid chemofossils in crude oils and sediments. Hollerbach, A. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 21 May 1980. 205p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83770373.

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The chapter of methods of analysis presents separation of extracts and oils, gaschromatography of alkane fraction, mass-spectrometric identification of terpene-like compounds and gaschromatographic-mass-spektrometric analysis of terpene-like chemofossils. The chapter on representation of results deals with deposit of steranes and pentacyclic triterpanes in crude oils of different age, steranes and triterpanes as correlation parameters between crude oils and source rocks, deposit of terpene-like compounds in coals of different mineralization and age and the deposit of terpene-like compounds in different single samples. The chapter of discussion of results treats deposit of terpene-like compounds in recent organisms, diagenesis of terpene-like compounds in sediments, the phylogenetic importance of terpene-like chemofossils in crude oils and sediments of different age, facial aspects of terpene-like chemofossils and behaviour of steranes and triterpanes during migration and accumulation.

0203 Drilling And Production

55443 (DOE/BC/00048—29) Selection of reservoirs amenable to micellar flooding. Final report, October 1978-December 1982. Goldburg, A.; Price, H.; Paul, G.W. (Gary Energy Corp., Englewood, CO (USA); Intercomp Resource Development and Engineering, Inc., Denver, CO (USA)). Aug 1983. Contract AC19-78BC00048;AC19-78BC00051. 154p. (DOE/BC/00051—29). NTIS, PC A08/MF A01. Order Number DE84000578.

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A Chemical Flood Predictive Model (CFPM) for micellar-polymer processes is developed. It consists of a technical screen, oil rate and recovery algorithms and an economics model. The CFPM is based upon an analysis of all available laboratory and field data (circa 1980) which leads to three efficiencies: E/sub D/, the surfactant pore displacement efficiency; E/sub V/, the efficiency of moving the surfactant from the injector to the pore space; and E/sub MB/, the efficiency of moving mobilized oil from that pore space to the producer. Oil timing is estimated from oil-water fractions flow theory. The CFPM is applicable to waterflooded sandstone reservoirs, and the effects of heterogeneity, crossflow between layers, and surfactant adsorption are included. The CFPM can be used to designate the better micellar-polymer prospects in Mid-Continent and California regions and can be used to aid in the design and development of micellar-polymer floods. 38 references, 50 figures, 15 tables.

55444 (DOE/BETC/IC—83/4) Abandoned oil fields in Oklahoma. Chism, J. (USDOE Bartlesville Energy Technology Center, OK). Aug 1983. 106p. NTIS, PC A06/MF A01. Order Number DE84000574.

Data are presented for approximately 165 abandoned oil fields in Oklahoma that have produced 10,000 or more barrels of oil prior to abandonment. The following information is provided for each field: county; DOE field code; field name; AAPG geologic province code; discovery date of field; year of last production, if known; discovery well operator; proven acreage; formation thickness; depth of field; gravity of oil production; calendar year; yearly field oil production; yearly field gas production; cumulative oil production; cumulative gas production; number abandoned fields in county; cumulative production of oil from fields; and cumulative production of gas from fields. (ATT)

55445 (DOE/BETC/RI—83/8) Role of crude-oil components in surfactant interaction. Tham, M.K.; Lorenz, P.B. (USDOE Bartlesville Energy Technology Center, OK). Sep 1983. 36p. NTIS, PC A03/MF A01. Order Number DE84001255.

Three crude oils from Bell Creek, Bradford, and Delaware-Childers fields were separated into distillates, acids, bases and heavy ends hydrocarbon. The effect of these components on the solubilization, optimal salinity, and bases shifted the optimal salinity significantly; their effects on the solubilization and interfacial tension are smaller. The bases appear to interact with the sulfonates, causing desorption from the interface, phase separation, and higher interfacial tension. The hydrocarbons, as expected have the strongest influence on the properties studied, due to their high concentration. The importance of the chemical nature and molecular weights of these components was also apparent. Even though the product $\sigma^{*2}\gamma$ is not constant, it was found that there is a definite relation between the solubilization (σ^*) and the interfacial tension (γ). This is true even for such complex compounds as acids and bases. 41 references, 6 figures, 14 tables.

55446 (DOE/ET/10327—19) Technical survey of polymer flooding projects. Manning, R.K.; Pope, G.A.; Lake, L.W.; Paul, G.W. (Texas Univ., Austin (USA); Intercomp Resource Development and Engineering, Inc., Denver, CO (USA)). Sep 1983. Contract AC19-80BC10327. 344p. NTIS MF A01. Order Number DE84001229.

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A comprehensive survey of polymer flooding projects is essential to a thorough evaluation of enhanced oil recovery methods. This work seeks to statistically analyze the actual and projected performance of these projects. The report establishes a large data base of oil recovery, reservoir, and fluid identifiers for abandoned, current, and contemplated projects. This data base was divided into subsets of field-wide and pilot projects. Statistics for each subset were determined separately, from both an analytical and a graphical perspective, and then were subsequently compared. One of the most important results found from these statistics is that the actual oil recovery of field-wide projects shows a close agreement with the majority of previous surveys in the literature, except with respect to the identifier, actual oil recovery (STB per lb polymer injected).

55447 (DOE/ET/12059—6) 200 Sand Steamflood Demonstration Project. Sixth annual report, June 1981-June 1982. Alford, W.O. (Santa Fe Energy Co., Santa Fe Springs, CA (USA). Western Div.). Aug 1983. Contract AC03-76ET12059. 22p. NTIS, PC A02/MF A01. Order Number DE84000576.

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This demonstration project was initiated in the 200 Sand Pool in the Midway-Sunset Field, California Sand Pool to demonstrate the operational, recovery, and economic aspects of steamflooding a typical heavy oil reservoir which had unfavorable response to cyclic stimulation. The scope of the project involves 5 phases: (1) pilot site monitoring and evaluation; (2) pilot area expansion; (3) site selection for expansion to full-scale project; (4) expansion to full-scale steamflood; and (5) production monitoring. After expansion and steam injection for one year, the wells are averaging 8 B/D oil and 29 B/D water per well. This rate is above the 5 BOPD for cyclic stimulation. Most of the producing wells are steam stimulated about twice a year to enhance steam breakthrough from the continuous steam. The total area has averaged 319 B/D oil and 1233 B/D water the last year. 7 figures, 1 table.

55448 **(DOE/ET/12267—1) Oil solubilization studies. Final report.** Carnali, J.; Fowkes, F.M. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). Jul 1983. Contract FG19-78ET12267. 43p. NTIS, PC A03/MF A01. Order Number DE84000239.

This report covers two studies of microemulsions pursued during a two-year starter grant from DOE. The first study was concerned with the thermodynamic activity of oil solubilized into swollen micelles in the presence of oil-soluble co-surfactants. Microemulsions using acidic cosurfactants were discovered and analytical methods were developed for the determination of cosurfactant concentrations in oil with the aim of determining the partition of cosurfactants into the oily core of swollen micelles. However, it was found that the oil-soluble indicator dyes were solubilized into the interfacial film of surfactant where they sensed the acidity or basicity of the aqueous phase rather than that of micellar core. This study will be continued with FTNMR, using carbon-13 NMR shifts to determine the proportion of co-surfactants solubilized into the core of oil-swollen micelles. In the second study the flocculation of certain soap-stabilized oil-in-water emulsions in the presence of salt up to 0.5 M was found to involve the development of a middle phase (M) which spread over oil droplets and displaced the aqueous phase (W) between oil (O) droplets, since γ/sub MO/ + γ/sub MW/ < γ/sub OW/. The contact angles between adjacent oil drop interfaces with the aqueous phase θ/sub W/), discovered by Princen and Aronson can be used to measure γ/sub MO/ and γ/sub MW/: cos θ/sub W/ = γ/sub MO//(γ/sub MO/ + γ/sub MW/) where the apparent O/W interface has become an O/M/W interface with the middle phase present and the apparent γ/sub OW/ interfacial tension has become γ/sub MO/ + γ/sub MW/. The onset, midpoint, and disappearance of the middle phase with increase in salinity is found at cos θ/sub W/ = 1,0, and -1. Proof of this mechanism involved small angle x-ray scattering studies of the lamella thickness between oil droplets; the 1000 A thickness refuted the previous explanation for the contact angles. 36 references, 17 figures, 5 tables.

55449 **(DOE/ET/13070—92) El Dorado Micellar-Polymer Demonstration Project. Eighth annual and final report, September 1981-November 1982.** Van Horn, L.E. (Cities Service Co., Wichita, KS (USA)). Sep 1983. Contract AC19-78ET13070. 240p. NTIS, PC A11/MF A01. Order Number DE84001231.

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Although the injection of drive water continues as of this writing and a complete evaluation is not possible, this report discusses the current working evaluations and performance predictions. Oil response to date has been disappointing and a total of 26,734 barrels of oil have been recovered to date with the South Pattern producing sixty percent more oil than the North Pattern. The forecast for total oil recovery is 29,800 barrels for the North Pattern. No forecast for total oil recovery in the South Pattern is available. It is expected, however, that the project will yield a total oil recovery efficiency which is less than half of the original predictions. Current operations are intended to optimize oil recovery utilizing the previously inactive pressure monitoring wells. Daily oil production, which is in excess of 35 barrels per day, is sufficient to generate revenue in excess of daily operating expenses. It is anticipated that the project operations will continue as long as oil production justifies the expense. The disappointing oil response has been attributed primarily to the inability of the designed preflushes to yield a salinity environment within the reservoir which was within the optimal salinity range for the surfactant (micellar) systems. The surfactants were, therefore, significantly less efficient at oil mobilization than expected. The extended lifetime of the project is due to a substantially lower injectivity than expected which prolonged fluid injection. Although this has been corrected to some degree, decreased productivity in the producing wells continues to keep project injection rates at lowered levels. The project must be classified as both a failure and a qualified success. Substantial volumes of oil were shown to be mobilized within the reservoir but only limited volumes of this mobilized oil are expected at the producing wells. 128 figures, 30 tables.

55450 **(DOE/SF/01424—47) Big Muddy Field low-tension flood-demonstration project. Fifth annual report, April 1982-March 1983.** Painter, T.R.; Borah, M.T.; Ferrell, H.H. (Conoco, Inc., Casper, WY (USA)). Aug 1983. Contract AC03-78SF01424. 124p. NTIS, PC A06/MF A01. Order Number DE84000240.

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The Big Muddy low-tension flood is a commercial-size demonstration project consisting of nine 10-acre injection patterns in the heart of the Big Muddy Oil Field located 15 miles east of Casper, Wyoming. The main goal of the project is to provide data for commercialization of the process for the Big Muddy Field and similar Wyoming and Colorado fields. This report discusses the project performance during the last part of slug injection with particular emphasis on the analysis of the early oil response and the injectivity. Other work discussed in this report includes the pilot testing for an oil-treating facility which led to a new design. The oil production rate increased from about 75 BPD at year-end 1981 to about 170 BPD, or from about 4 percent to about 11 percent of the injection rate, in March of 1983. During the same period, the produced oil cut increased from 2 percent to about 5 percent. The low-tension slug injection was completed in August 1982 and injection of a polymer solution having the same mobility is continuing. The total low-tension slug volume was 873,000 barrels or 10.2 percent pore volume. 4 references, 91 figures, 19 tables.

0206 Health And Safety

REFER ALSO TO CITATION(S) 56473, 56474

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 55443, 55869, 55870, 55871

55451 **(DOE/EIA—0109(83/09)) Petroleum supply monthly.** (USDOE Energy Information Administration, Washington, DC). Sep 1983. 90p. NTIS, PC A05/MF A01 - GPO. Order Number DE84000242.

This issue features Distillate Fuel Oil Overview: Winter 1983-84. This article discusses the outlook for distillate fuel oil during the upcoming heating season based on projections from the Energy Information Administration's most recent Short-Term Energy Outlook. This article is followed by Fuel Oil Trends which provides a petroleum overview and highlights distillate and residual fuel oil. A third article presents an advance summary of information from the US Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1982 Annual Report scheduled for release next month.

55452 **(EPA—450/3-80-038b) Bulk gasoline terminals: background information for promulgated standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Aug 1983. 186p. NTIS, PC A09/MF A01.

Standards of performance to control volatile organic compound emissions from new, modified, and reconstructed bulk gasoline terminal loading racks are being promulgated under the authority of Section 111 of the Clean Air Act. This document contains a detailed summary of the public comments on the proposed standards (45 FR 83126), responses to these comments and a summary of the changes to the proposed standards.

55453 **(NP—3770379) Oildorado '82.** (Esso A.G., Hamburg (Germany, F.R.)). 1982. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770379.

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Mineral oil consumption, oil- and natural gas production, refinery capacity and oil- and natural gas reserves are presented in tabular form for the year of the report, broken down in the Federal Republic of Germany, the countries of: Western Europe, Africa, the Middle East, North America, Middle- and South America, the Far East, Australia and the world as a whole.

0208 Waste Management

REFER ALSO TO CITATION(S) 55409, 55410

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 55456

0230 Properties

REFER ALSO TO CITATION(S) 55399, 55455

55454 (LMF—102, pp 33-38) **Surface area and adsorption studies on diesel exhaust particles.** Rothenberg, S.J.; Dutcher, J.S.; Cheng, Y.S.; Kittelson, D.B.; Kiyoura, R.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Specific surface area, desorption half-times and weight loss curves were determined for six samples of diesel exhaust particles from three different sources. Data were obtained over the temperature range 25°C to 600°C. Apparent specific surface areas were strongly dependent on the outgassing temperature, ranging from $\sim = 10\ m^2g^{-1}$ at 25°C to $\sim = 100\ m^2g^{-1}$ at 450°C. Desorption half-times exceeded a minute for all samples over the entire temperature range studied. Adsorption of m-xylene was studied over the relative pressure (P/P^0) range of 0.03 to 0.9. The adsorption properties of samples were as strongly dependent on the method of storage prior to analysis as on the source of the sample. The specific surface area of a sample stored in nitrogen from the time of sampling to the time of analysis exceeded that of air-stored samples by ~ 50 percent. The high adsorptive capacity of all the diesel samples studied suggested that the particles may have considerable capacity for catalyzing atmospheric reactions.

0240 Storage

REFER ALSO TO CITATION(S) 55822

55455 (DOE/BC/10435—1) **Laboratory study of the long-term mixing across the quiescent horizontal interface between two crude oils of different densities. Final report, October 1, 1981-May 1, 1983.** Sundaram, T.R. (T.S. Associates, Inc., Columbia, MD (USA)). Aug 1983. Contract AC19-81BC10435. 127p. NTIS, PC A07/MF A01. Order Number DE84000608.

The results of a laboratory study which was designed to delineate the long-term mixing processes that may occur across the hydrostatically-stable interface between two crude oils in field storage reservoirs is described. The laboratory tests were carried out in a 6′ x 1′ x 1′ plexiglass tank in which equal layers (each 6″ deep) of an Alaskan North Slope and an Arabian Light crude oil were introduced. Oil samples were acquired, over a period of 360 days, from several levels and horizontal positions within the test tank and were analyzed for density and viscosity as well as for sulfur and vanadium contents. The results show that a slow mixing between the two oil layers proceeds with increasing time, and that the vertical distributions of properties within the tank change gradually from the initial step profiles to smooth, monotonically varying ones. Since the distributions of the mixture properties about the original interface were not symmetric, especially at early test times, it appears that processes other than molecular diffusion alone may have been present; in particular, it appears from the data that a slow gravity-induced settling of some of the heavier oil constituents with respect to the others may have been superposed on the diffusional mixing. The aforementioned asymmetries appear, however, to be transient in nature, so that the density data at longer times appear to correlate reasonably well in terms of simple, binary-diffusion theory, for a value of the diffusion coefficient of about $0.5 \times 10^{-3}\ ft^2/day$. The foregoing value of the diffusion coefficient will only amount to a few feet even after several years. The report also describes the results of an ancillary study on the feasibility of delineating the characteristics of mixing in field reservoirs by using an optical techniue. 12 references, 48 figures, 24 tables.

55456 (DOE/PO/10850—T1) **Strategic Petroleum Reserve: brine-disposal studies in the Gulf of Mexico. Field and laboratory procedures manual.** Hann, R.W. Jr.; Giammona, C.P.; Randall, R.E. (eds.). (Texas A and M Univ., College Station (USA)). Sep 1983. Contract AC96-83PO10850. 397p. NTIS, PC A17/MF A01. Order Number DE84001024.

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The purpose of this manual is to describe the field and laboratory procedures which have been developed over the past five years and those currently in use for monitoring the effects of brine discharge on the marine environment in the Gulf of Mexico. Using such a manual provides a mechanism for updating procedures as changes occur, such as those for a monitoring plan change or the inclusion of the Big Hill site. The manual is divided into chapters which generally correspond to areas of responsibility of the principal investigators on the project team. These chapters are entitled Introduction (Chapter 1), Project Organization (Chapter 2), Objectives/Project Plan (Chapter 3), Field Operations (Chapter 4), Physical Oceanography (Chapter 5), CTD/DO and Brine Plume Tracking (Chapter 6), Water and Sediment Quality (Chapter 7), Special Pollutant Survey (Chapter 8), Phytoplankton (Chapter 9), Zooplankton (Chapter 10), Benthos (Chapter 11), Nekton (Chapter 12), and Data Management (Chapter 13). 65 references, 144 figures, 34 tables.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 55950

0301 Reserves

REFER ALSO TO CITATION(S) 55453

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 55464

55457 (SAND—83-2135C) **Seismic investigation of the Multi-Well Experiment site.** Searls, C.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 11p. (CONF-8310162—7). NTIS, PC A02/MF A01. Order Number DE84000943.

From Western gas sands sub-program review meeting; Morgantown, WV, USA (18 Oct 1983).

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A series of seismic studies were performed at the Department of energy Multi-Well Experiment site to delineate the character of the bedding within the Mesaverde group in western Colorado. The experiments consisted of a three-dimensional seismic survey of the area, a vertical seismic profile of two wells at the site and a cross borehole survey covering zones of special interest. Analysis of this data both as single experiments, and used in combination, is being used to determine the extent to which the geology may be inferred from seismic records. 2 references, 8 figures.

55458 (SAND—83-2140C) **Multi-Well Experiment core program.** Sattler, A.R. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-8310162—4). NTIS, PC A02/MF A01. Order Number DE84000483.

From Western gas sands sub-program review meeting; Morgantown, WV, USA (18 Oct 1983).

The Multi-Well Expeirment (MWX) is a research-oriented field laboratory and it is the major production technology activity of the Western Gas Sands Project. A major activity is the core analysis program: over 4000 ft of core were taken from three wells separated from each other by only about 100 to 200 ft at depth. All major categories of core analysis are reviewed and results through August 1983 are included. Those include routine core analysis, restored state reservoir parameter measurements, electrical measurements, mechanical rock property data, mineralogy, organic maturation, natural fractures, and geochemistry. This paper also de-

scribes the development of instruments that were used in the field processing of the core and other features of the core program.

0303 Drilling, Production, And Processing

55459 **(N—8323374) Research and development work concerning the separation of helium from gas mixtures by SiO_2 composite membranes. Final Report, Oct. 1981.** Kreiger, W.; Wiessart, P. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Dec 1982. 47p. (In serveral languages). (BMFT-FB-T—82-211; ISSN—0340-7608). NTIS, PC A03/MF A01.

Methods for the selective separation of helium from natural gas as an alternative to natural gas liquefaction was investigated. Composite membranes were examined for their usefulness for the separation of helium from a methane helium mixture. These composite membranes consisted of a polyimide film to which a thin silicon dioxide film was applied. A test apparatus was used for permeation measurements with helium, methane and a mixture of helium and methane at different temperatures and pressures. The permeation coefficients of helium and methane were determined, and the composition of the permeate was identified. It is found that helium is present in the permeate in a high concentration.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 55451, 55453, 55869

55460 **(DOE/EIA—0130(83/09)) Natural gas monthly.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Sep 1983. 114p. NTIS, PC A06/MF A01 - GPO. Order Number DE84000635.

This report presents current data on the consumption, production, prices, storage, import, export, extraction loss and estimated surplus of natural gas. In addition, data are presented for supplemental gaseous fuels, major interstate pipeline company statistics, and Natural Gas Policy Act. Featured article is on the average price of natural and supplemental gas delivered to consumers in 1982. (ATT)

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 56307, 56530

55461 **(CONF-8310162—6) In-situ stress measurements at DOE's multi-well experiment.** Warpinski, N.R.; Branagan, P.; Wilmer, R. (Sandia National Labs., Albuquerque, NM (USA); CER Corp., Las Vegas, NV (USA)). 1983. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01. Order Number DE84000486.

From Western gas sands sub-program review meeting; Morgantown, WV, USA (18 Oct 1983).

Measurements of the vertical distribution of the minimum principal in situ stress in the lower Mesaverde group (7300 to 8100 ft depth) at DOE's Multi-Well Experiment site have been made by conducting small-volume, hydraulic-fracture stress tests through perforations. Accurate, reproducible results were obtained by conducting a number of repeat injections in each zone of interest using a specially designed pump system, modified high-resolution electronic equipment, and a downhole shut-off tool with a bottom-hole pressure transducer. Stress tests were conducted in marine sandstones and shales as well as coal, mudstones, and sandstones in a paludal depositional environment; these tests provide a detailed stress distribution in this region. The stress magnitudes in blanket morphologies were found to be dependent on lithology. Marine shales above and below the blanket sands have large horizontal stresses - near lithostatic with a frac gradient greater than 1.0 psi/ft. On the other hand, sandstones and siltstones have much lower stresses with a frac gradient of 0.85 to 0.9 psi/ft. Containment of hydraulic fractures would be expected under these conditions. Stress tests conducted in the paludal interval gave frac gradients of approximately 0.88 to 0.98 psi/ft with no significant stress differences in various lithologies (sand, silt, mudstone, coal). Significant out-of-zone fracturing should be expected for hydraulic fracture treatments conducted in this interval. Two open-hole stress tests were conducted in a blanket sandstone to determine the orientation of the fractures, estimate the maximum principal in situ stress, and check the accuracy of the measurements through perforations. Maximum stresses were found to be about 400 psi greater than the minimum stress at a depth of 7500 to 7550 ft. 12 references, 5 figures, 1 table.

55462 **(SAND—83-1827C) Mineback Stimulation Research Program.** Warpinski, N.R. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 19p. (CONF-8310162—5). NTIS, PC A02/MF A01. Order Number DE84000351.

From Western gas sands sub-program review meeting; Morgantown, WV, USA (18 Oct 1983).

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The Mineback Stimulation Research Program is a systematic study of hydraulic fracturing and the parameters which influence or control fracture geometry or behavior. Fractures are created near a tunnel complex at DOE's Nevada Test Site and are monitored, instrumented, and mined back to observe the effect of treatment, rock and reservoir properties on the fractures. An initial experiment to measure width and pressure in a hydraulic fracture was completed in FY 1983. The test showed that pressure drops along fractures are much larger than predicted, with the result that fractures are shorter, higher, and wider than present models estimate. The cause of this is the complex morphology of hydraulic fractures, including a hierarchy of roughnesses, multiple stranding, and corners, such as the offsets which occur when natural fractures are intersected. A test to study flow behavior in hydraulic fractures with proppant is proposed for FY 1984. 7 figures.

55463 **(SAND—83-2100C) MWX stimulation experiments.** Northrop, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-8310162—1). NTIS, PC A02/MF A01. Order Number DE84000352.

From Western gas sands sub-program review meeting; Morgantown, WV, USA (18 Oct 1983).

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No stimulations have been conducted at the Multi-Well Experiment site through the end of Fiscal Year 1983. Nevertheless, efforts have been made to define the zones of interest, objectives, and methodology for the series of stimulation experiments which will be conducted beginning in Fiscal Year 1984. The first stimulation experiment will be conducted in the paludal interval in the Mesaverde Group. A request for proposal (RFP) for service company participation has been prepared. 3 figures.

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

REFER ALSO TO CITATION(S) 55465

55464 **(DOE/ET/12131—1399) Intergrated study of the Devonian-age black shales in eastern Ohio. Final report.** Gray, J.D.; Struble, R.A.; Carlton, R.W.; Hodges, D.A.; Honeycutt, F.M.; Kingsbury, R.H.; Knapp, N.F.; Majchszak, F.L.; Stith, D.A. (Ohio Dept. of Natural Resources, Columbus (USA). Div. of Geological Survey). Sep 1982. Contract AS21-76ET12131. 1663p. NTIS, PC A99/MF A01. Order Number DE83011204.

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This integrated study of the Devonian-age shales in eastern Ohio by the Ohio Department of Natural Resources, Division of Geological Survey is part of the Eastern Gas Shales Project sponsored by the US Department of Energy. The six areas of research included in the study are: (1) detailed stratigraphic mapping, (2) detailed structure mapping, (3) mineralogic and petrographic characterization, (4) geochemical characterization, (5) fracture trace and lineament analysis, and (6) a gas-show monitoring program. The data generated by the study provide a basis for assessing the most

promising stratigraphic horizons for occurrences of natural gas within the Devonian shale sequence and the most favorable geographic areas of the state for natural gas exploration and should be useful in the planning and design of production-stimulation techniques. Four major radioactive units in the Devonian shale sequence are believed to be important source rocks and reservoir beds for natural gas. In order of potential for development as an unconventional gas resource, they are (1) lower and upper radioactive facies of the Huron Shale Member of the Ohio Shale, (2) upper Olentangy Shale (Rhinestreet facies equivalent), (3) Cleveland Shale Member of the Ohio Shale, and (4) lower Olentangy Shale (Marcellus facies equivalent). These primary exploration targets are recommended on the basis of areal distribution, net thickness of radioactive shale, shows of natural gas, and drilling depth to the radioactive unit. Fracture trends indicate prospective areas for Devonian shale reservoirs. Good geological prospects in the Devonian shales should be located where the fracture trends coincide with thick sequences of organic-rich highly radioactive shale.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 55465

0404 Oil Production, Recovery, And Refining

55465 **(BMFT-FB-T—83-148) Economic recovery and processing of posidonia shale in the investigation area of Schandelah.** Kruk, H.U.; Czibulinski, U.; Schulze, R.; Harjung, J.; Frohnert, H.; Orlowski, W.; Drescher, J.; Ebert, L.; Ernst, H.; Schmitz, H.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1983. 30p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751346.

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The object of the investigations, which took several years, was to test most up-to-date technologies in the fields of mining and chemical process engineering applied to posidonia shale of the Schandelah deposit type with regard to an economic recovery and processing of this primary energy source in the Braunschweig-Wolfsburg-Koenigslutter area. The results have shown that about two billion tons of oil shale can be exploited and possibly commercially utilized in this area. The importance of these results is given by the fact that in this economic domain a primary energy source with a thermal value of about 8.2 EJ has been detected, which can produce at least 100 million tons of syncrude. If this deposit is to be used for producing electrical energy it can provide about 800 TWh.

55466 **(DOE/LC/10787—118) Investigation of the Geokinetics horizontal in-situ oil-shale retorting process. Quarterly report, April-June 1983.** Henderson, K.B. (Geokinetics, Inc., Salt Lake City, UT (USA)). Sep 1983. Contract FC20-78LC10787. 38p. NTIS, PC A03/MF A01. Order Number DE83018282.

The objective is to develop an in situ process for recovering shale oil using a fire front moving in a horizontal direction. The project is being conducted at a field site, Kamp Kerogen, located 70 miles south of Vernal, Utah. There are no retort nor production data included in this report because no retort was burned nor oil produced during the second quarter. Reclamation work has begun on Retorts number 24, number 25, and number 26. Final preparations were made in May to ignite Retort number 27. Five post-blast packer tests on Retort number 28 have been finished and results should be available in July. Construction of the off gas processing plant for Retorts number 27 and number 28 began in April. To date, the oil storage tanks, demister tanks, air coolers, ammonia absorber and stripper, the afterburner stack, the H_2S absorber, the steam generator, the ammonia stripper reboiler, and a small heat exchanger have been installed. The gas piping including the by-pass system through the plant is complete; the installation of process piping in the ammonia plant is nearly complete. Process modifications have delayed the piping in the sulfur plant. The ignition, vacuum and spare blowers are all operational. 10 figures, 4 tables.

55467 **(DOE/METC/SP—197) Oil shale combustion/retorting.** (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). May 1983. 49p. NTIS, PC A03/MF A01. Order Number DE83017038.

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The Morgantown Energy Technology Center (METC) conducted a number of feasibility studies on the combustion and retorting of five oil shales: Celina (Tennessee), Colorado, Israeli, Moroccan, and Sunbury (Kentucky). These studies generated technical data primarily on (1) the effects of retorting conditions, (2) the combustion characteristics applicable to developing an optimum process design technology, and (3) establishing a data base applicable to oil shales worldwide. During the research program, METC applied the versatile fluidized-bed process to combustion and retorting of various low-grade oil shales. Based on METC's research findings and other published information, fluidized-bed processes were found to offer highly attractive methods to maximize the heat recovery and yield of quality oil from oil shale. The principal reasons are the fluidized-bed's capacity for (1) high in-bed heat transfer rates, (2) large solid throughput, and (3) selectivity in aromatic-hydrocarbon formation. The METC research program showed that shale-oil yields were affected by the process parameters of retorting temperature, residence time, shale particle size, fluidization gas velocity, and gas composition. (Preferred values of yields, of course, may differ among major oil shales.) 12 references, 15 figures, 8 tables.

0405 Properties And Composition

55468 **(DOE/ER/60122—1) Properties of spent shales. Progress report.** (Colorado State Univ., Fort Collins (USA)). 1983. Contract AC02-83ER60122. 44p. NTIS, PC A03/MF A01. Order Number DE84000855.

Separate abstracts were prepared for the 3 separate reports.

55469 (DOE/ER/60122—1, pp 1-12) **Water and heat transport in oil-shale solid wastes. Progress report, January 1, 1983-July 31, 1983.** McWhorter, D.B. (Colorado State Univ., Fort Collins). 1983. NTIS, PC A03/MF A01.

In Properties of spent shales. Progress report.

Research objectives are to measure the relationships among volumetric water content, apparent pore-water pressure, and hydraulic conductivity over the pressure range of 0 to 80 atmospheres in retorted oil shales and to measure the heat capacity and thermal conductivity of retorted shale. The effects of salts in the solution caused problems in the gamma attenuation measurement of the water content of the spent shales and it was necessary to resort to methods in which water content were determined gravimetrically. The heat capacity of 5 different retorted shales was measured as a function of temperature at 20 to 130°C. Thermal conductivities at three water contents were measured for TOSCO II spent shale by establishing a nearly steady heat flux of known magnitude and measuring the corresponding temperature gradient.

55470 (DOE/ER/60122—1, pp 13-28) **Geotechnical engineering aspects of long-term stability of retorted oil shale. Progress report, January 1, 1983-July 31, 1983.** Nelson, J.D.; Madrid, L.D. (Colorado State Univ., Fort Collins). 1983. NTIS, PC A03/MF A01.

In Properties of spent shales. Progress report.

Shear strength and other related engineering properties of retorted oil shale as related to long-term deformations, seepage, and overall stability.

55471 (DOE/ER/60122—1, pp 29-44) **Stress-strain-strength properties of spent shale under different temperatures. Progress report.** Chang, N.Y.; Wu, T.H. 1983. NTIS, PC A03/MF A01.

In Properties of spent shales. Progress report.

A portion of the test program designed to evaluate the physical properties and the stress-strain-strength properties of Tosco II spent shale has been completed. Three triaxial cells were modified to test spent shale at temperatures up to 210°F. While the data analysis and testing are still progressing, some preliminary results

are available. The results show a certain degree of temperature dependence of the stress-strain-strength behavior of the Tosco II spent shale. The hyperbolic stress-strain law developed by Kondner and Zelasko and extended by Duncan and Chang can closely simulate the stress-strain-strength characteristics of spent shale at above normal temperatures.

0407 Health And Safety

55472 **(LA—9659-MS) Occupational-health study at the Geokinetics true in-situ oil-shale retorting facility.** Hargis, K.M.; Rom, W.N.; Grier, R.S.; Tillery, M.I.; Voelz, G.L.; Ettinger, H.J.; Wheat, L.D. (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 57p. NTIS, PC A04/MF A01. Order Number DE84000108.

An occupational health study was conducted during the burn of the first commercial-size retort employing the Geokinetics, Inc., horizontal in situ oil shale retorting process. The study consisted of field industrial hygiene surveys and sampling, and medical evaluation of workers and spouses living at the facility. Industrial hygiene surveys and sampling were conducted during early, middle, and late phases of the 9-month burn of the retort. An attempt was made to sample areas of expected maximum concentrations in order to characterize air contaminants near process units or areas, rather than to sample actual employee exposures. Samples were collected for analysis of dust and a number of selected gases and vapors in air, and limited monitoring was conducted for noise. Limited dust monitoring was also conducted during the drilling of blastholes for another retort. Medical evaluations consisted of medical history, physical examination, pulmonary ventilation function tests, chest x ray, and blood and urine tests (including chromosome evaluations and Ames testing of urine). 30 references.

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 55465

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 55466

05 NUCLEAR FUELS

0502 Exploration

55473 **(GJBX—34-83-Vol.1) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume I. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 97p. NTIS, PC E08/MF $10.00. Order Number DE84000074.

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An airborne combined radiometric and magnetic survey was performed over the Sierra Madre Detail Area of southeastern Wyoming. This area covers the Sierra Madre and Medicine Bow Mountains which are within the coverage of the Rawlins 1° by 2° map sheet of the National Topographic Map Series. The latitude and longitude bounds of the project area are 106° by 107°15′ east-west and 41° by 41°45′ north-south. The survey was part of DOE's National Uranium Resource Evaluation program. Data were collected by a helicopter equipped with a gamma-ray spectrometer with a large crystal volume, and with a high sensitivity proton precession magnetometer. The radiometric system was calibrated at the Walker Field Calibration pads and the Lake Mead Dynamic Test Range. Data quality was ensured during the survey by daily test flights and equipment checks. Radiometric data were corrected for live time, aircraft and equipment background, cosmic background, atmospheric radon, Compton scatter, and altitude dependence. The corrected data were statistically evaluated, gridded, and contoured to produce maps of the radiometric variables, uranium, potassium, and thorium; their ratios; and the residual magnetic field. These maps have been analyzed in order to produce a multi-variant analysis contour map based on the radiometric response of the individual geological units. A geochemical analysis has been performed, using the radiometric and magnetic contour maps, the multi-variant analysis map; and factor analysis techniques, to produce a geochemical analysis map for the area.

55474 **(GJBX—34-83-Vol.2A) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II A. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 250p. NTIS, PC A11/MF A01. Order Number DE84000072.

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Volume 2-A contains the following information relative to the Sierra Madre detail area of Wyoming: geology, radioactive mineral occurrences in Wyoming and geophysical data interpretation. Six appendices are included: geologic histograms; geochemical histograms; speed and altitude histograms; geologic statistical tables; geochemical statistical tables; and test line data.

55475 **(GJBX—34-83-Vol.2B) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II B. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 507p. NTIS, PC A22/MF A01. Order Number DE84000073.

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Volume 2-B contains the radiometric profiles (all tie lines and profile lines 1 to 100) for the Sierra Madre detail area of Wyoming.

55476 **(GJBX—34-83-Vol.2C) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II C. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 496p. NTIS, PC A21/MF A01. Order Number DE84000075.

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Volume 2-C contains magnetic and ancillary profiles (all the lines and map lines 1 to 100) for the Sierra Madre detail area of Wyoming.

55477 **(GJBX—34-83-Vol.2D) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II D. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 515p. NTIS, PC A22/MF A01. Order Number DE84000076.

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Volume 2-D contains five appendices: flight line maps, geology maps, geologic legend, flight line/geology overlays, and radiometric contour maps. This information pertains to Sierra Madre, Wyoming.

55478 **(GJBX—34-83-Vol.2E) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II E. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 175p. NTIS, PC A08/MF A01. Order Number DE84000078.

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Volume 2-E contains three appendices (magnetic maps, multi-variant analysis maps, and geochemical factor analysis maps) pertaining to the Sierra Madre detail area of Wyoming.

55479 **Uranium logging with prompt fission neutrons.** Humphreys, D.R.; Barnard, R.W.; Bivens, H.M.; Jensen, D.H.; Stephenson, W.A.; Weinlein, J.H. (Sandia National Labs., Albuquerque, NM (USA)). *International Journal of Applied Radiation and Isotopes;* **34**: No. 1, 261-268(Jan 1983).

This paper describes a uranium logging probe which can assay U_3O_8 concentrations as low as 100 ppm at 0.5 m/min. The probe sends 100 pulses per second of 14 MeV neutrons (2 x 10^9 neutrons/pulse) into the formation surroundings a borehole, and detects prompt epithermal neutrons returning from fissioning ^{235}U. Various models of the probe have logged hundreds of boreholes in the Western United States since 1976. The neutron generator is now commercially available and the probe design is available to the public.

55480 **(GJBX—34-83-Vol.2B1) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II B1. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 497p. NTIS, PC A21/MF A01. Order Number DE84000155.

Portions are illegible in microfiche products.

Volume 2B1 contains the radiometric profiles (map lines 101 to 249) for Sierra Madre, Wyoming.

55481 **(GJBX—34-86-Vol.2C1) Airborne gamma-ray spectrometer and magnetometer survey: Sierra Madre, Wyoming, detail area. Volume II C1. Final report.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692;AC13-76GJ01664. 507p. NTIS, PC A22/MF A01. Order Number DE84000077.

Portions are illegible in microfiche products.

Volume 2-C1 contains the magnetic and ancillary profiles (map lines 101 to 249) for the Sierra Madre detail area of Wyoming.

0503 Mining

55482 (CONF-8210168—, pp 145-148) **Nuclear waste management: a federal perspective.** Oertel, G.K. (US Dept. of Energy, Washington, DC). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Recent legislative, technical, and operational developments affect US nuclear waste management. Low-level wastes will be the responsibility of the states. The federal government assumes responsibility for high-level commercial wastes, with the user and beneficiary paying the cost, and for its own radioactive wastes. These will be stored in federal repositories or processed to recover usable materials. (DCK)

0504 Feed Processing

55483 **(EGG-MS—6351) Scoping studies on recovery of uranium from man-made ores.** Miller, R.L.; Welch, J.M.; Flinn, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1983. Contract AC07-76ID01570. 11p. NTIS, PC A02/MF A01. Order Number DE84000880.

The potential for recovery of enriched uranium from spent nuclear fuel which has been consolidated into a nuclear waste form was explored in the studies reported here. The waste form of interest is iron-enriched basalt (IEB), a silicate-based, fused-cast ceramic. The IEB samples, or man-made uranium ores (MMUO), are in two different mineralogical forms. From the results of the scoping tests, it is suggested that there is little difference in the two samples in terms of recovery of uranium. It is also suggested that the ore can be opened and the uranium recovered by either a sodium hydroxide fusion or sulfuric acid leaching. The sodium hydroxide fusion method gave the best recovery but requires the most energy and has the greatest operational complexity. The sulfuric acid/hydrogen peroxide leach gave intermediate results but is easier to handle. The sodium carbonate/sodium bicarbonate/hydrogen peroxide gave unacceptable recovery. Improved uranium recovery using the sodium hydroxide fusion method could probably be achieved by using a strong oxidant such as sodium peroxide or sodium nitrate in the fusion step. The fusion method relied on air oxidation of the uranium and was controlled by either the rate of dissolution of oxygen in the melt or by diffusion of the dissolved oxygen. Increasing the oxygen overpressure may offer an alternative to air oxidation. The recommendation made in regard to the oxidants is that other oxidants be tested, in terms of species, as well as concentration. The beneficial effect of increasing the sodium hydroxide to ore ratio is evident from the data. The use of sodium hydroxide beyond that required for fusion at 800°C should be studied. Sulfuric acid leaching could probably be improved by control of acid and oxidant concentrations and by reducing the particle size.

0505 Enrichment

REFER ALSO TO CITATION(S) 55551

55484 **(UCRL—15545) Safety analysis of SISL process module.** (Fauske and Associates, Inc., Burr Ridge, IL (USA)). May 1983. Contract W-7405-ENG-48. 96p. NTIS, PC A05/MF A01. Order Number DE84000171.

This report provides an assessment of various postulated accidental occurrences within an experimental process module which is part of a Special Isotope Separation Laboratory (SISL) currently under construction at the Lawrence Livermore National Laboratory (LLNL). The process module will contain large amounts of molten uranium and various water-cooled structures within a vacuum vessel. Special emphasis is therefore given to potential accidental interactions of molten uranium with water leading to explosive and/or rapid steam formation, as well as uranium oxidation and the potential for combustion. Considerations are also given to the potential for vessel melt-through. Evaluations include mechanical and thermal interactions and design implications both in terms of design basis as well as once-in-a-lifetime accident scenarios. These scenarios include both single- and multiple-failure modes leading to various contact modes and locations within the process module for possible thermal interactions. The evaluations show that a vacuum vessel design based upon nominal operating conditions would appear sufficient to meet safety requirements in connection with both design basis as well as once-in-a-lifetime accidents. Controlled venting requirements for removal of steam and hydrogen in order to avoid possible long-term pressurization events are recommended. Depending upon the resulting accident conditions, the vacuum system (i.e., the roughing system) could also serve this purpose. Finally, based upon accident evaluations of this study, immediate shut-off of all coolant water following an incident leak is not recommended, as such action may have adverse effects in terms of cool-down requirements for the melt crucibles etc. These requirements have not been assessed as part of this study.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 56188

55485 **(DP—1665) Study of the U_3O_8-Al thermite reaction and strength of reactor fuel tubes.** Peacock, H.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1983. Contract AC09-76SR00001. 26p. NTIS, PC A03/MF A01. Order Number DE84000850.

Heating tests using 53 wt % U_3O_8-Al pellets show that an exothermic reaction occurs between 875 and 1000°C and takes 10 to 20 seconds to reach maximum temperature. The maximum temperature is a function of particle size of the U_3O_8 with large particles exhibiting lower peak temperatures. The calculated energy release was 123 cal/g of U_3O_8-aluminum fuel. Tests using aluminum clad outer fuel tube sections gave lower peak temperatures than for pellets. No violent reactions occurred. The results are reasonably consistent with recent reported data indicating that the exothermic U_3O_8-Al reaction is not an important energy source. The compressive and tensile strengths of U_3O_8 tubes above 660°C are low. In compression, sections with 2 psi average axial stress failed at 917°C, while sections with 7 psi failed at 669°C. Tubes with U-Al

alloy cores failed at about 670°C with no applied load. The stresses in fuel tubes during a reactor transient may range up to several hundred psi and are less than 7 psi only in the upper part of the fuel tube.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 55517, 56137

55486 **(CONF-830808—12) Alternate extractants to tributyl phosphate for reactor fuel reprocessing.** Crouse, D.J.; Arnold, W.D.; Hurst, F.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84000202.

From International solvent extraction conference; Denver, CO, USA (26 Aug 1983).

Both tri(n-hexyl) phosphate (THP) and tri(2-ethylhexyl) phosphate (TEHP) have some important potential process advantages over TBP for reactor fuel reprocessing. These include negligible aqueous phase solubility and less tendency toward third phase and crud formation. The alkyl chain branching of TEHP makes it much more stable to chemical degradation than TBP and probably also accounts for its much weaker ruthenium extraction. The higher uranium and plutonium extraction power of THP and TEHP allows higher solvent loadings in extraction but makes them somewhat more difficult to strip. The phase separation properties of 1.09 M solutions of THP and TEHP are inferior to those of 1.09 M TBP (30 vol %) but are favorable at lower concentrations. Use of more dilute THP and TEHP solutions is recommended for this reason and to obtain a better balance of extraction power in the extraction versus stripping steps.

55487 (CONF-8210168—, pp 137-144) **What to do with spent fuel.** Gilinsky, V. (Nuclear Regulatory Commission, Washington, DC). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

US nuclear power plants are running out of storage space for radioactive spent fuel because the reprocessing part of the fuel cycle has been dropped to prevent plutonium diversion for weapons use. Most utilities can expand their storage capacity, but new storage techniques, such as rod consolidation or dry casks, and new facilities will be needed. A long-term disposal plan continues to recede into the future, although there is some progress in the Nuclear Regulatory Commission's repository licensing rules. Safe and reliable interim-storage plans could be to collect spent fuel from reactor sites and store it at central facilities. New interest in reprocessing could cause additional legislative delays. (DCK)

55488 **(DOE-tr—257) Report of working group on spent-fuel management, Paris, France, 1 December 1982.** (Pacific Northwest Lab., Richland, WA (USA); Ministere de l'Industrie, 75 - Paris (France)). Mar 1983. Contract AC06-76RL01830. Translation source information not available . 407p. NTIS, PC A18/MF A01. Order Number DE83018093.

Portions are illegible in microfiche products.

Chapter 1 of this report examines the reprocessing situation in the current (UP2) and future (UP2-800, UP3 and STE3) plants at La Hague, from the standpoint of installation availability, personnel and environmental protection, wastes produced and operating safety. Chapter 2 is devoted to variants and other methods of spent fuel reprocessing. Chapter 3 deals with options other than immediate reprocessing. Chapter 4 discusses the final objectives of immediate reprocessing and of these other options, and attempts to make a comparison between these different methods of managing spent fuels. The recommendations that the Group felt its duty to express are reproduced in italics in the report. Among these recommendations, those on which the Group wishes to place special emphasis are repeated in Chapter 5.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 55482, 55502, 56209

55489 **(INIS-mf—8495) Transport of plutonium nitrate.** (UKAEA Headquarters, London). 1982. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703490.

This leaflet discusses the subject under the headings: why do we need plutonium; why must we transport it; what action is carried out; how is it moved; what are the risks. The transport of the material in specially designed containers, from Dounreay in Caithness by road and sea to Sellafield in Cumbria, is described. (U.K.).

55490 **(NUREG—0383-Vol.2-Rev.6) Directory of certificates of compliance for radioactive materials packages. Volume 2, Revision 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Fuel Cycle and Material Safety). Sep 1983. 623p. NTIS, PC A99/MF A01 - GPO $11.00. Order Number DE84900043.

This directory contains a Summary Report of NRC Approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory. Shipments of radioactive material utilizing these packagings must be in accordance with the provisions of 49 CFR 173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12, it is the responsibility of the licensees to insure them that they have a copy of the current approval and conduct their transportation activities in accordance with an NRC approved quality assurance program. Copies of the current approval may be obtained from the US Nuclear Regulatory Commission Public Document Room files (see Docket No. listed on each certificate) at 1717 H Street, Washington, DC 20555. Note that the general license of 10 CFR 71.12 does not authorize the receipt, possession, use or transfer of byproduct source, or special nuclear material; such authorization must be obtained pursuant to 10 CFR Parts 30 to 36, 40, 50, or 70.

55491 **(NUREG—0383-Vol.3-Rev.3) Directory of certificates of compliance for radioactive materials packages: summary report of NRC approved quality-assurance programs for radioactive-material packages. Volume 3, Revision 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Sep 1983. 138p. NTIS, PC A07/MF A01 - GPO $5.50. Order Number DE84900037.

This directory contains a Summary Report of NRC Approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory. Shipments of radioactive material utilizing these packagings must be in accordance with the provisions of 49 CFR 173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12, it is the responsibility of the licensees to insure them in accordance with an NRC approved quality assurance program. Copies of the current approval may be obtained from the US Nuclear Regulatory Commission Public Document Room files (see Docket No. listed on each certificate) at 1717 H Street, Washington, DC 20555. Note that the general license of 10 CFR 71.12 does not authorize the receipt, possession, use or transfer of byproduct

source, or special nuclear material; such authorization must be obtained pursuant to 10 CFR Parts 30 to 36, 40, 50, or 70.

55492 (NUREG/CR—3452) Mechanical analysis of a transportation accident involving empty shipping casks for radioactive materials near Hilda, South Carolina, in November 1982. Kong, M.K.; Walter, C.E.; Woo, H.H. (Lawrence Livermore National Lab., CA (USA)). Aug 1983. Contract W-7405-ENG-48. 45p. (UCRL—53484). NTIS, PC A03/MF A01 - GPO. Order Number DE84000558.

An accident involving a passenger automobile and a tractor-trailer carrying two empty shipping casks for transporting low-level radioactive materials occurred on November 3, 1982, near Hilda, SC. The purpose of this report is to document the mechanical circumstances of the accident, and to assess the types and magnitudes of accident environments to which the casks were subjected. The report contains two major parts. The first concerns the accident description, which includes fact-finding and the inferred accident scenario. The second part deals with the mechanical analysis of the accident, consisting of estimates of the impact loads and an assessment of the response of the casks and their tie-down systems. Discussions of results and recommendations are also included. 10 references, 25 figures, 1 table.

55493 (PNL—4857) Intermodal transportation of spent fuel. Elder, H.K. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 92p. NTIS, PC A05/MF A01. Order Number DE84000190.

Concepts for transportation of spent fuel in rail casks from nuclear power plant sites with no rail service are under consideration by the US Department of Energy in the Commercial Spent Fuel Management program at the Pacific Northwest Laboratory. This report identifies and evaluates three alternative systems for intermodal transfer of spent fuel: heavy-haul truck to rail, barge to rail, and barge to heavy-haul truck. This report concludes that, with some modifications and provisions for new equipment, existing rail and marine systems can provide a transportation base for the intermodal transfer of spent fuel to federal interim storage facilities. Some needed land transportation support and loading and unloading equipment does not currently exist. There are insufficient shipping casks available at this time, but the industrial capability to meet projected needs appears adequate.

55494 (PNL-SA—11614) Economics of spent fuel storage options at reactor sites. Holter, G.M.; Merrill, E.T. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 6p. (CONF-830905—7). NTIS, PC A02/MF A01. Order Number DE83018283.

From Joint power generation conference; Indianapolis, IN, USA (25 Sep 1983).

This paper summarizes the results of studies carried out under DOE's Commercial Spent Fuel Management Program to estimate the costs that would be incurred by a nuclear utility in providing enhanced onsite storage capability for spent light water reactor)LWR) fuel. The basic estimated storage costs include cost factors or arrays for each alternative method of storage considered, as well as the additional costs involved in various options of pre-atorage preparation of the fuel. Cost data are provided for (1) storage enhancement within an existing storage pool, by reracking and/or consolidation of fuel; (2) construction and use of an additional, separate water basin for storage; and (3) utilization of dry storage options (metal casks, drywells, concrete silos, or storage vaults). In addition, costs are given for canning of integral assemblies and for consolidation and canning of fuel. In each case, the storage facilities are assumed to be located at an existing reactor site; if a separate site were to be utilized for storage, appropriate site development and maintenance costsx would need to be added. The basic cost tables are tied together by a decision tree logic diagram designed to simulate the decision steps a utility planner might take in selecting from alternative storage technologies to best meet the requirements of his situation.

55495 (SAND—83-2092C) Transportation research activities in support of nuclear waste management programs. Allen, G.C. Jr.; Cashwell, J.W.; Jefferson, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-830905—8). NTIS, PC A02/MF A01. Order Number DE84000464.

From Joint power generation conference; Indianapolis, IN, USA (25 Sep 1983).

Transportation Technology Center has been conducting a wide range of technical research activities to assure the ability to transport radioactive materials in a safe, reliable manner. These activities include tasks in basic, analysis methodology and system research areas. Recently, the requirements of defense waste shipments have served as a focal point for development tasks with the expectation that they would serve as a precursor for commercial activities. The passage of the Nuclear Waste Policy Act has placed additional responsibility on the Department of Energy for concerns involving the shipments of civilian materials. The development of additional research responsibilities is expected to proceed concurrently with the evolution of the transportation mission plan for civilian spent fuel and high-level wastes.

0520 Waste Management

REFER ALSO TO CITATION(S) 55487, 55545, 55547, 55550, 56091, 56348, 56524

55496 (ANL—83-19) Fuel cycle programs. Quarterly progress report, October-December 1982. Steindler, M.J.; Bates, J.K.; Cannon, T.F.; Couture, R.A.; Deeken, P.G.; Fagan, J.E.; Gerding, T.J.; Hoh, J.C.; Kincinas, J.E.; Kolba, V.M. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 182p. NTIS, PC A09/MF A01. Order Number DE84000191.

An information base has been assembled for the future analysis of concepts for disposing of ^{85}Kr, ^{129}I, ^{3}H, and ^{14}C from the nuclear fuel cycle. A blanket processing program emphasizing tritium recovery and effective heat transfer is in progress. The current experiment designated TRIO-01 is designed to test the performance of a miniaturized solid breeder blanket assembly with continuous in situ recovery of tritium. The thermal-hydraulic response of solid breeder blankets and the tritium system problems associated with liquid metal blankets are being analyzed. Thermal-hydraulic analysis is also being supplied for the First Wall/Blanket/Shield Program. Tritium needs and systems required for both tokamak and mirror fusion reactors are being supplied. Work is being done on (1) the sealing properties of fresh and altered proposed backfill materials for high-level nuclear waste in the expected hydrothermal, high-radiation environments of repositories, (2) the extent to which radioactivity might move from a nuclear waste repository because of flowing groundwater, (3) the effects of dissolved organic acids on the partitioning of ^{241}Am and ^{237}Np between synthetic groundwater and crushed basalt, and (4) the partitioning of a small group of toxic phenol compounds between dolomite and water. Development and testing of equipment for the destructive analysis of full-length irradiated fuel rods from the Light Water Breeder Reactor are in progress. Work has been done on: (1) the full-scale shear, (2) the dual dissolver system, (3) scrap and waste disposal, (4) the process control and data management system, and (5) analytical systems. Testing of simulated nuclear waste glasses is being done by exposing preleached Savannah River Laboratory type 131 glass to a second static leach test and by hydrating tektite glass meteorites and Pacific Northwest Laboratories type 76-68 glass in water vapor at elevated temperatures.

55497 (ANL—83-57-Pt.1) Compatibility of technologies with regulations in the waste management of H-3, I-129, C-14, and Kr-85. Part I. Initial information base. Trevorrow, L.E.; Vandegrift, G.F.; Kolba, V.M.; Steindler, M.J. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 190p. NTIS, PC A09/MF A01. Order Number DE84000985.

This report summarizes the information base that was collected and reviewed in preparation for carrying out an analysis of the compatibility with regulations of waste management technol-

ogies for disposal of H-3, I-129, C-14, and Kr-85. Based on the review of this literature, summaries are presented here of waste-form characteristics, packaging, transportation, and disposal methods. Also discussed are regulations that might apply to all operations involved in disposal of the four nuclides, including the processing of irradiated fuel in a fuel reprocessing plant, packaging, storage, transport, and final disposal. The compliance assessment derived from this information is reported in a separate document. 309 references.

55498 **(BNL-NUREG—33192) Draft technical position on waste-package reliability.** Sastre, C.; Prince, A.; Pescatore, C. (Brookhaven National Lab., Upton, NY (USA)). May 1983. Contract AC02-76CH00016. 71p. NTIS, PC A04/MF A01. Order Number DE84000540.

A method for the evaluation of reliability of a high-level waste package to comply with the requirements of 10 CFR 60 is being proposed. The method is based on the repetitive usage of a performance model for values of the model parameters which span their range of uncertainty. The techniques for selecting values for the input parameters, viewed as random variables, and for generating empirical correlations among experimental data are described and illustrated with an example of a simplified waste package analysis.

55499 **(BNL-NUREG—33627) Analyses of soils at commercial radioactive waste disposal sites.** Piciulo, P.L.; Shea, C.E.; Barletta, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 11p. (CONF-8308106—11). NTIS, PC A02/MF A01 - GPO. Order Number DE84000621.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Brookhaven National Laboratory, in order to provide technical assistance to the NRC, has measured a number of physical and chemical characteristics of soils from three commercial low-level radioactive waste disposal sites. Samples were collected from an area adjacent to the disposal site at Sheffield, IL, and from two operating sites: one at Barnwell, SC, and the other near Richland, WA. The soil samples, which were analyzed from each site, were believed to include soil which was representative of that in contact with buried waste forms. Results of field measurements of earth resistivity and of soil pH will be presented. Additionally, the results of laboratory measurements of resistivity, moisture content, pH, exchange acidity and the soluble ion content of the soils will be discussed. The soluble ion content of the soils was determined by analysis of aqueous extracts of saturated soil pastes. The concentrations of the following ions were determined: Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}, HCO_3^{-}, CO_3^{2-}, SO_4^{2-}, Cl^{-}, S^{2-}.

55500 (CONF-8210168—, pp 149-152) **Nuclear waste management in Illinois.** Gustafson, P.F. (Illinois Dept. of Nuclear Safety, Springfield). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

This paper addresses nuclear waste production and its management as it now exists in Illinois in three categories: (1) radioactive waste from pre-nuclear era activities, (2) spent nuclear fuel, and (3) low-level waste. The state has responsibility for categories 1 and 3, and, although spent fuel is a federal responsibility, the state is also involved because of on-site storage at seven commercial power plants. State concerns center on the possibility that the General Electric-Morris facility may become a federally operated away-from-reactor (AFR) site if pending legislation passes and the fact that current Illinois law prohibits the shipment of additional spent fuel to GE-Morris for storage.

55501 **(CONF-8308106—10) Corrective measures technology for humid sites.** Spalding, B.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE84000718.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The corrective measures technology task for humid sites consists of three subtasks. The first subtask has the objective of demonstrating that grout injection into closed burial trenches can achieve the hydrologic isolation of buried wastes. From laboratory testing of seven grout formulations, two promising grouts, 7.6% sodium silicate and 11.7% acrylamide, were selected for field demonstration by injection into 1:10-scale burial trenches. Both grouts effected a several orders of magnitude reduction in the mean hydraulic conductivity of the trench. The trench chemical treatment subtask has the objective of demonstrating the caustic soda injection into a closed trench's backfill and surrounding soil can achieve a fixation of radiostrontium from further ground water contamination. Monitoring of ground waters in and around the treated trench indicate a continued fixation of radiostrontium from further leaching. Soil samples were taken from the trench and found to contain ^{90}Sr coprecipitated with calcium carbonate. The final subtask has the objective of demonstrating that the detection and treatment of ground water seeps can achieve a significant reduction in radiostrontium contamination of surface water. The utility of measuring ^{90}Sr in ground water samples by Cerenkov radiation detection was found to be analytically equivalent to but considerably less expensive and time consuming than the standard radiochemical method.

55502 **(CONF-8308111—2) Handling and disposing of radioactive waste.** Trauger, D.B. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE83017221.

From Conference on the future of nuclear power; Nara, Japan (22 Aug 1983).

Radioactive waste has been separated by definition into six categories. These are: commercial spent fuel; high-level wastes; transuranium waste; low-level wastes; decommissioning and decontamination wastes; and mill tailings and mine wastes. Handling and disposing of these various types of radioactive wastes are discussed briefly.

55503 **(DOE/ID/12371—3) Low-level radioactive waste facility siting in the Rocky Mountain compact region.** Whitman, M. (Colorado Office of the Governor, Denver (USA)). Sep 1983. Contract FG07-82ID12371. 25p. NTIS, PC A02/MF A01. Order Number DE84000312.

The puprose of the Rocky Mountain Low-Level Radioactive Waste Compact is to develop a regional management system for low-level waste (LLW) generated in the six states eligible for membership: Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. Under the terms of the compact, any party state generating at least 20% of the region's waste becomes responsible for hosting a regional LLW management facility. However, the compact prescribes no system which the host state must follow to develop a facility, but rather calls on the state to fulfill its responsibility through reliance on its own laws and regulations. Few of the Rocky Mountain compact states have legislation dealing specifically with LLW facility siting. Authority for LLW facility siting is usually obtained from radiation control statutes and solid or hazardous waste statutes. A state-by-state analysis of the siting authorities of each of the Rock Mountain compact states as they pertain to LLW disposal facility siting is presented. Siting authority for LLW disposal facilities in the Rocky Mountain compact region runs from no authority, as in Wyoming, to general statutory authority for which regulations would have to be promulgated, as in Arizona and Nevada, to more detailed siting laws, as in Colorado and New Mexico. Barring an amendment to, or different interpretation of, the Utah Hazardous Waste Facility Siting Act, none of the Rocky Mountain States' LLW facility siting authorities preempt local veto authorities.

55504 **(DOE/ID/12372—1) Low-level radioactive material information management system. Final report.** (Southern States Energy Board, Atlanta, GA (USA)). Sep 1983. Contract FG07-82ID12372. 321p. NTIS MF A01. Order Number DE84001251.

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The Southern States Energy Board (SSEB) has designed and tested a monitoring system for reporting and tracking the movement of low-level radioactive waste from generator through transporter or broker to disposal site. This demonstration project has

been an attempt to show the feasibility of a system with wider regional and national scope. In conjunction with the development of this closed-loop system, a low-level waste generators' survey has been conducted in 10 pilot states to collect, analyze and present low-level waste data for state management purposes. These states are Alabama, Florida, Georgia, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

55505 **(DOE/SR-WM—84-1) Savannah River interim waste management program plan, FY-1984.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Sep 1983. Contract AC09-76SR00001. 190p. NTIS, PC A09/MF A01. Order Number DE84000579.

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This document provides the program plan as requested by the Savannah River Operations Office of the Department of Energy. The plan was developed to provide a working knowledge of the nature and extent of the interim waste management programs being undertaken by Savannah River contractors for the Fiscal year 1984. In addition, the document projects activities for several years beyond 1984 to adequately plan for safe handling and storage of radioactive wastes generated at Savannah River and for developing technology for improved management of low-level solid wastes. A revised plan will be issued prior to the beginning of the first quarter of each fiscal year. In this document, work descriptions and milestone schedules are current as of the date of publication. Budgets are based on available information as of June 1983.

55506 **(DOE/UMT—0216) Liner evaluation for uranium mill tailings. Final report.** Buelt, J.L. (comp.). (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 182p. (PNL—4842). NTIS, PC A09/MF A01. Order Number DE84001253.

The Liner Evaluation for Uranium Mill Tailings Program was conducted to evaluate the need for and performance of prospective lining materials for the long-term management of inactive uranium mill tailings piles. On the basis of program results, two materials have been identified: natural foundation soil amended with 10% sodium bentonite; catalytic airblown asphalt membrane. The study showed that, for most situations, calcareous soils typical of Western US sites adequately buffer tailings leachates and prevent groundwater contamination without additional liner materials or amendments. Although mathematical modeling of disposal sites is recommended on a site-specific basis, there appears to be no reason to expect significant infiltration through the cover for most Western sites. The major water source through the tailings would be groundwater movement at sites with shallow groundwater tables. Even so column leaching studies showed that contaminant source terms were reduced to near maximum contaminant levels (MCL's) for drinking water within one or two pore volumes; thus, a limited source term for groundwater contamination exists. At sites where significant groundwater movement or infiltration is expected and the tailings leachates are alkaline, however, the sodium bentonite or asphalt membrane may be necessary.

55507 **(EGG-M—18883) Waste Experimental Reduction Facility description and progress report, August 1983.** Logan, J.A.; Larsen, M.M.; Maughan, R.Y.; Nelson, J.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 17p. (CONF-8308106—12). NTIS, PC A02/MF A01. Order Number DE84000726.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

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This paper traces the establishment of and describes the current characteristics of the Waste Experimental Reduction Facility, now processing low-level beta/gamma contaminated waste at the Idaho National Engineering Laboratory. It outlines principal findings and facility changes that occurred during the facility startup period (September 1982 to July 1983) while sizing (cutting) and melting uncontaminated metal in preparation for processing contaminated metal, which commenced in July 1983. It also briefly describes processing experiences thus far with contaminated metal.

55508 **(EGG-WM—6097) Comparison of properties of centrifugally cast and wrought stainless steels with similar chemical composition for DWPF canisters.** Howell, R.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1982. Contract AC07-76ID01570. 25p. NTIS, PC A02/MF A01. Order Number DE84000249.

This report compares the properties of centrifugally cast stainless steel and plate stainless steel (wrought). The comparison was to determine whether centrifugally cast cylinders are an acceptable alternative to wrought, rolled and welded cylinders. After comparing the two materials, it was found that the castings meet or exceed the requirements of the proposed DWPF (Defense Waste Project Facility) canister design. Recommendations for future action are: that the molten steel used to make the centrifugal castings must be processed by an Argon Oxygen Decarburizer (AOD) prior to casting, and that the effect of partially heat treating an as-cast centrifugal casting should be evaluated. This evaluation is to determine the metallurgical affect of pouring molten borosilicate glass into a casting and allowing the casting cool at ambient temperature.

55509 **(GSF-T—136(Bd.1)) Performance test of the shaft Konrad for ultimate storage of radioactive wastes. Vol. 1.** (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Jun 1982. vp. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.).

The geology of the shaft area and the structure and properties of the deposit are appropriate for the safe ultimate storage of low-level radioactive wastes and decommissioning wastes. The results confirm the nuclear safety of the shaft. The developed technical concepts are important planning aids for construction, operation and shutdown of the ultimate storage facility. All findings gathered from research and development work as well as the main data of the site have been compiled.

55510 **(IEAL—318) Summary of principal new (1/1/82 - 4/1/83) developments relating to the siting of waste management facilities. 1983 supplement to IEAL-232.** Paige, H.W.; Owens, J.E. (International Energy Associates Ltd., Washington, DC (USA)). Aug 1983. Contract AC06-81NE44148. 92p. NTIS, PC A05/MF A01. Order Number DE84000146.

This is the third in a series of periodic surveys of approaches and progress in other countries in dealing with the problems of obtaining local acceptance for siting of waste management facilities. The countries included in this report are: Austria, Belgium, Canada, Denmark, Federal Republic of Germany, Finland, France, Italy, Japan, Mexico, Netherlands, Spain, Sweden, Switzerland, and United Kingdom.

55511 **(INIS-mf—8488) Management of nuclear waste. A new film from the UKAEA.** (UKAEA Headquarters, London). 1982. 1p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703511.

55512 **(INIS-mf—8496) Disposal of radioactive waste in the Atlantic.** (UKAEA Headquarters, London). 1982. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703512.

An operation to dispose of low-level radioactive waste in the North Atlantic deeps is undertaken each year. This leaflet seeks to answer questions which are sometimes asked about the operation. It deals with origin, composition, quantity, reason for sea- rather than land-disposal, packaging, transport (rail, road), route of transport, safety precautions, radiation protection, personnel, contamination, site of dump, international regulations, neutral observers, safety standards of containers and control of level of radioactivity of wastes. (U.K.).

55513 **(INIS-mf—8500) Nuclear waste management.** (UKAEA Headquarters, London). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703501.

The subject is discussed, with special reference to the UK, under the headings: radiation; origins of the waste (mainly from nuclear power programme; gas, liquid, solid; various levels of activity); dealing with waste (methods of processing, storage, disposal); high-active waste (storage, vitrification, study of means of eventual disposal); waste management (UK organisation to manage low and intermediate level waste). (U.K.).

55514 **(INIS-mf—8513) Waste management in connection with ore-processing and in conversion and enrichment plants.** Fourcade, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 62p. (CONF-8209134—7). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703498.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

In order to define the management of uranium mill tailings which represent sources of radionuclides their characteristics must first be known, i.e. their composition and the amounts stored, together with the geographic, hydrologic, climatological, demographic characteristics of the storage area and the near environment. The kinetics of radionuclide releases via air and water are described and the parameters that must be controlled in order to quantify and eventually reduce the releases are specified. Such studies are essential both for future and present storage. For present storage safe management requires a surveillance and an assessment of the environmental impact by monitoring of air and water vectors and chemical analyses of the physical and biological media and the food chain. A pre-operational survey is necessary. The present state of knowledge derived from monitored sites forbidden to unauthorized public demonstrates that the population exposure is low, within the range of natural fluctuations. However, if one considers the objectives of protection optimization (the ICPR principle) reasonable solutions liable to result in public exposures as low as possible - especially after discontinuance of operation - must be presented taking into account the information available on each site. The best solution shall be chosen according to safety, protection and cost criteria.

55515 **(INIS-mf—8514) Waste management in MOX fuel fabrication plants.** Schneider, V. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 24p. (CONF-8209134—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703499.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

After a short description of a MOX fuel fabrication plant's activities the waste arisings in such a plant are discussed according to nature, composition, Pu-content. Experience has shown that proper recording leads to a reduction of waste arisings by waste awareness. Aspects of the treatment of chemical bond-waste are given and a number of treatment processes are reviewed. Finally, the current waste management practice and the chemical bond-waste treatment facility under construction at ALKEM are outlined. (orig./RW).

55516 **(INIS-mf—8515) Waste management in light-water reactors.** Meininger, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 8p. (CONF-8209134—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703502.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

The most important objectives of concentrate and solid waste treatment are reduction of the waste to the smallest volume, radioactive exposure of the personnel of the power plants and outside for operation, handling and transportation, protection against migration of the concentrated radioactive substances after final disposal and observance of shipping requirements, national laws and ministerial waste storage regulations. A variety of technologies is available for the realization of these objectives. Important parameters for the selection and design of concentrate and solid waste treatment processes are waste type, quantity, activity, means for immobilization and the achievable reduction factors. The most important technologies for the treatment of liquid concentrates, combustible and non-combustible solid waste are available for example: In-Drum-Drying, Borate-Solidification (PWR), Drum Drier, Residue Filter Drying, Bituminization, Solidification with cement, Incineration, Shredding, Compacting etc. and of course combinations of the various mentioned procedures which result in the best possible waste disposal for the entire power plant. (orig./RW).

55517 **(INIS-mf—8516) Waste management in reprocessing plants.** Mortreuil, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 18p. (CONF-8209134—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703500.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

This lecture will give a survey of the French policy for the management of wastes in reprocessing plants. In consideration of their radioactivity, they must be immobilized in matrix in such a manner that they are stored under optimal safety conditions. A general review on the nature, nucleide content and quantity of the various wastes arising from thermal nuclear fuel reprocessing is given in the light of the French plants UP1 at Marcoule and UP2 at La Hague. The procedures of treatment of such wastes and their conditioning into inert packages suitable for temporary or terminal storage are presented, especially concerning the continuous vitrification process carried out for fission product solutions. The requirements of each option are discussed and possible alternative solutions are exposed. (orig./RW).

55518 **(INIS-mf—8517) Treatment of gaseous and airborne radioactive waste.** Leichsenring, C.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 15p. (CONF-8209134—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703503.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

Gaseous and airborne radionuclides in the fuel cycle are retained in vessel off-gas filter systems and in the dissolver off-gas cleaning system. Those systems have to meet the regulatory requirements for both normal and accident conditions. From the solutions liquid aerosols are formed during liquid transfer (air lifts, steam jets) or by air sparging or by evaporation processes. During dissolution the volatile radionuclides i.e. ^{85}Kr, ^{129}I and ^{14}C are liberated and enter into the dissolver off-gas cleaning system. Flow sheets of different cleaning systems and their stage of development are described. (orig./RW).

55519 **(INIS-mf—8518) Alternative waste management concept for medium and low level wastes by in-situ solidification.** Kraemer, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 15p. (CONF-8209134—12). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703504.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

Since 1976, a German R and D project has been carried out to find an alternative concept for the treatment and disposal of MLW and LLW arising mainly in the planned German reprocessing plant and other nuclear facilities (LWR, fuel fabrication, R and D establishments). The main feature of this concept is an in-situ solidification of preconditioned waste granules in large salt caverns located in the deep geological underground, thus avoiding such non-radioactive ballast as lost concrete shielding and container material. (orig./RW).

55520 **(INIS-mf—8519) Treatment of liquid radioactive waste: Evaporation.** Pfeiffer, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 51p. (CONF-8209134—13). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703505.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

About 10.000 m³ of low active liquid waste (LLW) arise in the Nuclear Research Center Karlsruhe. Chemical contents of this liquid waste are generally not declared. Resulting from experiments carried out in the Center during the early sixties, the evaporator facility was built in 1968 for decontamination of LLW. The evaporators use vapor compression and concentrate recirculation in the evaporator sump by pumps. Since 1971 the medium active liquid waste (MLW) from the Karlsruhe Reprocessing Plant (WAK) was decontaminated in this evaporator facility, too. By this time the amount of low liquid waste (LLW) had been decontaminated without mentionable interruptions. Afterwards a lot of interruptions of operations occurred, mainly due to leakages of pumps, valves and pipes. There was also a very high radiation level for the operating personnel. As a consequence of this experience a new evaporator facility for decontamination of medium active liquid waste was built in 1974. This facility started operation in 1976. The evaporator has natural circulation and is heated by steam through a heat exchanger. (orig./RW).

55521 **(INIS-mf—8520) Treatment of liquid radioactive waste: Precipitation.** Gompper, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 16p. (CONF-8209134—14). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703506.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

After introductory remarks about waste types to be treated, specific treatment methods are discussed and examples are given for treatment processes carried out with different types of liquid wastes from nuclear power plants, research centers and fuel reprocessing plants. (RW).

55522 **(INIS-mf—8521) Treatment of solid radioactive waste: Volume reduction of non-combustible waste.** Boehme, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 22p. (CONF-8209134—15). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703507.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

Press compaction is very common as for volume reduction of low level radioactive solid waste. In most cases a sorting step and if necessary a fragmenting step are desirable prior to the compaction process. Besides contamination-free loading and unloading techniques are important. Typical technical solutions for mixed solid waste handling and compacting equipment are shown and discussed by means of the lay-out drawings for a medium size radwaste compaction facility. A special technique can be applied if one has to compact active exhaust air filters in a hot cell. KfK has developed a remotely operated mobile equipment for this purpose. As for the nuclear fuel cycle considerable interest is existing in compacting spent fuel halls after fuel dissolution. In various European countries mechanical compaction and high temperature processes are therefore under development. These processes are described and the related equipment is discussed. (orig./RW).

55523 **(INIS-mf—8522) Treatment of solid radioactive waste: The incineration of low level radioactive waste.** Dirks, F.; Hempelmann, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 17p. (CONF-8209134—16). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703508.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

Nuclear facilities produce large quantities of burnable solid radioactive waste which incineration can reduce in volume and change into a form capable of ultimate storage. Experiments over many years were carried out at the Karlsruhe Nuclear Research Center to determine the boundary conditions for the design and construction of incineration plants for radioactive waste. On the basis of those experiments a test facility was started up in 1971. This operating facility consists of a shaft furnace lined with ceramics with a downstream series of ceramic flue gas filters. In 1976 the plant was exchanged by the installation of a pilot facility for burning organic solvents and of a flue gas scrubber. The plant has so far been in operation for more than 28000 hours and has processed in excess of 1500 to of solid and some 300 m³ of liquid low level radioactive wastes. Various repairs and interventions were carried out without greatly impairing availability, which was 81 % on the average. The plant design is being used by various licensees in Japan and Europe; three plants are either in operation or completed, three more are under construction or in the planning stage. On the basis of the available process an incineration plant for alpha contaminated waste will be built at the Karlsruhe Nuclear Research Center in the next few years. (orig.).

55524 **(INIS-mf—8523) Treatment of concentrated waste for storage. Fixation with bitumen.** Vidal, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703509.

The french experience in bituminization of radioactive wastes is described through the successive items, an outline on the industrial realizations is followed by the inventories of the costable wastes, the constraints to be respected for embedding and quality of bitumen to be used. The technological aspect is described with the example of brennilis, characteristics and properties of coated wastes are given in conclusion. (orig./RW).

55525 **(INIS-mf—8524) Vitrification of high active waste. Vitrification techniques.** Sombret, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 81p. (CONF-8209134—18). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703510.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

The main stream of high level radioactive materials generated as wastes by the reprocessing of spent nuclear fuel is composed of fission products solutions. The storage of these liquids has been operated until now in stainless steel tanks almost everywhere. From a general standpoint, it is now assumed that these solutions, in which long-life actinides are also present, must be solidified owing to the hazards related to a long term disposal. Vitrification has generally been taken more into consideration than other processes owing to a relatively simple implementation and mainly because glass is a medium flexible enough to house the various elements bound to be present in the radioactive liquids without inducing drastic changes in the physicochemical properties. Among these properties particular attention is paid to the ones connected to the fabrication: corrosiveness, volatilization, viscosity as well as to the interim storage and long term disposal: thermal stability, chemical stability versus β \ and chemical bond irradiation including the subsequent effects of helium build up. Investigations in those fields have been carried out principally on borosilicate and aluminoborosilicate glasses. The manufacture techniques under development are numerous. Some of them are continuous processes, other are batch ones. Both can involve either a one stage or a two stage fabrication. The most advanced technique is a 2 stages continuous process involving calcination in a rotary tube and vitrification in a metallic melter. (orig./HW).

55526 **(INIS-mf—8525) Underground disposal of high active waste.** Engelmann, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 13p. (CONF-8209134—19). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703513.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

This paper is concerned with the engineering aspects relating to the deep burial of high active waste in stable geological formations. The design of a repository depends upon a number of factors not least of which is the type of rock in which it is to be constructed. High level wastes must be isolated from man's environment for such periods that subsequent release will not result in an unacceptable hazard to human population. Design aspects of repositories are reviewed and conceptual designs are present in relation to the geological formations under consideration. Over long time periods the most probable mode of release of radionuclides is through groundwater contacting the waste. The proposed concepts therefore include the use of engineered and natural barriers to delay the even-

tual release of waterborne radionuclides into mans environment. In all cases the ultimate barrier will be the geological formation. Nevertheless, depending upon the type of host rock, use will be made of various additional engineered barriers to delay water contacting the high level waste for several hundreds of years. During this time the level of radiation and associated heat emitted by the waste, will fall by several orders of magnitude and the rock temperatures within a repository will be returning to ambient. Thereafter the residual activity will mainly arise from the actinides. Containment may be enhanced by surrounding the canisters with materials having high sorption capabilities for many of the radionuclides involved. The depth at which a repository is excavated must be sufficient to ensure that the overburden will withstand changes in environmental conditions. The depth of cover required in different rock types may vary. In clay excavating at depth of up to -250 m appears feasible, while in hard rocks and salts working at depth of up to -1000 m is entirely practicable. (orig./RW).

55527 **(LA—9831-MS) Radiological survey following decontamination activities near the TA-45 site.** Gunderson, T.; Buhl, T.; Romero, R.; Salazar, J. (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 16p. NTIS, PC A02/MF A01. Order Number DE84000106.

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Three areas at the site of a former radioactive liquid waste treatment plant at Los Alamos National Laboratory were decontaminated during 1982 by Bechtel Corporation, with health physics support provided by Eberline Instrument Corporation, under the Department of Energy's Formerly Utilized Sites Remedial Action Program (FUSRAP). Before decontamination, there were above-background concentrations of gross alpha, gross beta, ^{238}Pu, $^{239,240}Pu$, ^{241}Am, ^{90}Sr, and ^{137}Cs in the surface soils. These combined concentrations were above operational decontamination guidelines for surface soil contamination. After cleanup operations, radionuclide concentrations in surface soils at all three sites were within decontamination guidelines.

55528 **(LA-UR—83-2591) Field studies and modeling of chemical processes in the unsaturated zone.** DePoorter, G.L.; Langhorst, G.J.; Steger, J.G. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 10p. (CONF-8308106—13). NTIS, PC A02/MF A01. Order Number DE84001352.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Computer models used to predict site performance of low-level radioactive waste disposal facilities must accurately describe the chemical processes and hydrologic conditions that determine radionuclide leaching and transport in the unsaturated zone. Work to date to define these chemical processes and hydrologic conditions includes a detailed literature survey, computer modeling, preparation of a draft test plan, and preliminary mineralogical analyses of materials proposed for use in the experiments. Applicable previous work is described in relation to the specific questions of NRC. The experiments proposed and the computer modeling using TRACR3D to define the experiments are presented in detail. Sampling and analytical methods for both the solid and liquid phases are described. The relationship of this project to the waste form and leaching studies currently being performed by the Brookhaven National Laboratory will be disucssed.

55529 **(MLM—3096) TRU waste certification: experimental data and results.** Lewis, E.L. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 30 Sep 1983. Contract AC04-76DP00053. 17p. NTIS, PC A02/MF A01. Order Number DE84001216.

As part of the TRU waste certification program at Mound, experiments were performed, and the results were used to verify certification of various TRU wastes with regard to specific WIPP (Waste Isolation Pilot Plant) criteria. Particle-size determinations of soils and Florco absorbent showed that this absorbent is a suitable waste material. On the other hand, some samples of dried soil failed to meet the WIPP particle-size criterion. Gas-generation testing (radiolytic) of two waste forms was accomplished. In addition, the bacterial and radiolytic gas generation testing of a third form of waste soil was completed. The maximum allowable contamination (plutonium-238) levels (nCi/g) of the three waste forms were determined from the experimental data. A simulated transportation (vibration) test of a container of sludge/cement proved that this waste form was a solid mass that would not crumble into smaller pieces during shipment.

55530 **(NUREG/CR—3203) In-situ dewatering techniques for uranium mill tailings.** Wardwell, R.E.; Nelson, J.D.; Abt, S.R.; Staub, W.P. (Oak Ridge National Lab., TN (USA); Colorado State Univ., Fort Collins (USA). Dept. of Civil Engineering). Sep 1983. Contract W-7405-ENG-26. 72p. (ORNL/TM—8689). NTIS, PC A04/MF A01 - GPO. Order Number DE84000480.

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The state-of-the-art regarding methods for the in-place dewatering of uranium mill tailings is described. Since large amounts of water in tailing impoundments can cause long-term seepage problems, drainage of the tailings both during operations and during the reclamation stage is highly desirable. Dewatering of tailings also provides for settlement prior to the placement of the cover and increases the pile's stability for earth-moving equipment during site reclamation and cover placement. The application of various drainage techniques is discussed with regard to their effectiveness in minimizing the amount of water remaining in an impoundment during long-term reclamation. Drainage techniques that are reviewed include underdrain gravity-flow systems, single wells and well-points, electro-osmosis, vertical drains, and evapotranspiration. It has been shown that the underdrain gravity systems provide an effective and reliable means of dewatering tailings. If feasible, they will probably prove to be the best option for the in situ dewatering of tailings because of their practicality and relatively low cost. The other methods would be recommended only as backup systems or in existing impoundments that do not have underdrain systems.

55531 **(NUREG/CR—3472-Vol.1) Surface properties and performance prediction of alternative waste forms. Annual report, October 1, 1981-September 30, 1982. Volume 1.** Hench, L.L.; Clark, D.E. (Florida Univ., Gainesville (USA). Coll. of Engineering). Sep 1983. 102p. NTIS, PC A06/MF A01 - GPO $4.75. Order Number DE84900049.

Leaching mechanisms of simulated HLW-borosilicate glasses are studied by various surface spectroscopic measurement and solution chemistry analysis. The variables included in this annual report are: degree of glass fracture, glass composition, devitrification, and wet-dry cyclic effect.

55532 **(NUREG/CR—3487) Regional-interstate site-review procedure: low-level radioactive waste disposal facility.** (Southern States Energy Board, Atlanta, GA (USA)). Sep 1983. 121p. NTIS, PC A06/MF A01 - GPO $5.00. Order Number DE84900066.

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The attributes of the Southern States Energy Board (SSEB) enable it to view federal/state interface problem areas from a perspective that can be uniquely constructive. The board is sensitive to the interests of both federal and state levels of government since it is composed of member states with common regional interests and confirmed by federal legislative action. It has been most effective when exercising a leadership role in finding procedures and practices that use the resources of both levels of government that are mutually supportive and nonduplicative. SSEB began an NRC-funded effort in that direction related to nuclear power plant siting in June 1975, entitled Regional-Interstate Nuclear Facility Siting Procedure Demonstration Project. SSEB approached the problem by working with interested states to analyze various elements of the licensing process, in particular with NEPA review procedures for interstate coordination where potential impacts extend beyond a single state and where the facility serves an interstate or regional need. SSEB also served as a catalyst in the development of a region-wide nuclear facility siting procedure that could improve the effectiveness and timeliness of the regulatory process.

55533 (NUREG/CR—3494) Reliability of geotechnical, environmental, and radiological instrumentation in nuclear waste repository studies. Rogue, F.; Binnall, E.P. (Lawrence Livermore National Lab., CA (USA)). Jan 1983. Contract W-7405-ENG-48. 153p. (UCID—19467). NTIS, PC A08/MF A01 - GPO. Order Number DE84000515.

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The task reported herein examines the reliability of instrumentation which may be used at future waste repository sites. Using studies of instrument reliability and failure mechanisms and on-site observations of instruments under actual operating conditions, this report assesses the status of instrument reliability in specific areas of waste repository instrumentation and identifies needed improvements. Visits to Department of Energy (DOE) waste repository experimental sites have yielded first-hand observations of problems, and progress made by DOE experimenters in solving some of these problems. This report can aid in the development of regulatory guidance for conditions of application or on acceptable limits of instrument operation.

55534 (ONWI—455) Functional design criteria for the exploratory shaft in salt. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jul 1983. Contract AC06-76RL01830;AC02-83CH10140. 44p. NTIS, PC A03/MF A01. Order Number DE84001218.

The purpose of the Functional Design Criteria is to provide technical direction for the development of detailed design criteria for the exploratory shaft facility. This will assure that the completed exploratory shaft facility design is in accordance with the ONWI mission as well as the National Waste Terminal Storage program directives. The functional design criteria are not intended to limit or constrain the designer's flexibility to design. However, the following design philosophies will be incorporated in the designs: The exploratory shaft will be designed to fulfill its intended purpose and mission. Sound engineering principles and practices will be consistently applied. The health and safety of the public and the workers will be an essential factor in the design. The exploratory shaft will be designed to achieve economy in its construction, operation, and maintenance. All applicable federal, state, and local laws and regulations, as well as all applicable national consensus codes and standards, will be satisfied. The adverse impact to the environment will be minimized.

55535 (ONWI—493) Conceptual test plan for site confirmation testing at an exploratory shaft in salt. Ubbes, W.F. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1983. Contract AC06-76RL01830;AC02-83CH10140. 39p. NTIS, PC A03/MF A01. Order Number DE84001008.

This document is developed to discuss, from a conceptual standpoint, the types of information that may be needed from an exploratory shaft facility and to describe the kinds of in situ tests that could be conducted to obtain that information during site confirmation testing. Site confirmation testing is designed to provide information to satisfy the stated objectives by supplying input parameters for performance assessment models and by direct observation of the host formation.

55536 (ORNL—5887) Application of the carbon dioxide-barium hydroxide hydrate gas-solid reaction for the treatment of dilute carbon dioxide-bearing gas streams. Haag, G.L. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 298p. NTIS, PC A13/MF A01. Order Number DE84000039.

Thesis. Submitted to the Univ. of Tennessee, Knoxville.

The removal of trace components from gas streams via irreversible gas-solid reactions in an area of interest to the chemical engineering profession. This research effort addresses the use of fixed beds of $Ba(OH)_2$ hydrate flakes for the removal of an acid gas, CO_2, from air that contains ~ 330 ppM/sub v/ CO_2. Areas of investigation encompassed: (1) an extensive literature review of $Ba(OH)_2$ hydrate chemistry, (2) microscale studies on 0.150-g samples to develop a better understanding of the reaction, (3) process studies at the macroscale level with 10.2-cm-ID fixed-bed reactors, and (4) the development of a model for predicting fixed-bed performance. Experimental studies indicated fixed beds of commercial $Ba(OH)_2.8H_2O$ flakes at ambient temperatures to be capable of high CO_2-removal efficiencies (effluent concentrations <100 ppB), high reactant utilization (>99%), and an acceptable pressure drop (1.8 kPa/m at a superficial gas velocity of 13 cm/s). $Ba(OH)_2.8H_2O$ was determined to be more reactive toward CO_2 than either $Ba(OH)_2.3H_2O$ or $Ba(OH)_2.1H_2O$. A key variable in the development of this fixed-bed process was relative humidity. Operation at conditions with effluent relative humidities >60% resulted in significant recrystallization and restructuring of the flake and subsequent pressure-drop problems.

55537 (ORNL/TM—8694) Provisional monitoring program for SWSA 7. Lomenick, T.F.; Byerly, D.W.; Gonzales, S. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01. Order Number DE84000616.

The program plan for developing a new Solid Waste Storage Area (SWSA 7) to handle low-level radwastes generated at Oak Ridge National Laboratory states that a monitoring program is paramount to safe and efficient operation of such a facility. To be monitored are the principal pathways of potential radionuclide migration, including the groundwater and surface-water systems, the atmosphere, and the biota inhabiting the site. Three phases of monitoring various parameters of these pathways would be necessary during development of SWSA 7 to ensure compliance with criteria and guidelines proposed by such organizations as the Nuclear Regulatory Commission, the Environmental Protection Agency, the Department of Energy, and the Tennessee Department of Health. This provisional program addresses the three phases of monitoring necessary for SWSA 7: (1) pre-operational monitoring, for baseline information; (2) operational monitoring for detection of unacceptable radionuclide migration and/or excessive occupational levels; and (3) post-closure monitoring.

55538 (PNL—4796) Mobility of organic complexes of nickel and cobalt in soils. Swanson, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 68p. NTIS, PC A04/MF A01. Order Number DE83017897.

This is the third and final report on a study of the effect of organic complexing agents on the behavior of low-level waste radionuclides in soil/groundwater systems. Work done in FY 1983 showed that sorption of some complexed radionuclides, as well as of uncomplexed ones, is important with some soils. Sorption of Ni-EDTA and Co-EDTA complexes occurs with soils from Oak Ridge and Savannah River. The sorption of these kinetically inert complexes results in a lower radionuclide migration rate than if it did not occur; however, the migration rate is still greater than if the complexes were not kinetically inert, or if complexants were absent. The comparison of complexing agents was also extended in FY 1983 to include additional individual agents and also some proprietary decontamination mixtures. These tests included study of the fate of some complexants themselves as well as study of their effects on radionuclide distribution. The results of these tests continue to indicate that all organic complexing agents should not be considered to be equally hazardous from a waste disposal standpoint. Different soils affect organic complexant-enhanced radionuclide mobility differently. Some sorb kineticaly inert complexes and some do not. Radionuclide complexes dissociate more rapidly in some soil/groundwater systems than they do in others. Soils also differ in their leaching by complexant solutions, which also affects radionuclide behavior. Data were obtained in this area during FY 1983. Other site-specific factors, such as hydrologic ones, are very important to radionuclide migration and to the possible effects of organic complexation. There appear to be a number of combinations of site-specific and complexant-specific factors that can give radionuclide mobilities that are acceptably small even in the presence of complexants. 16 references, 17 figures, 6 tables.

55539 (PNL—4819) Off-gas characteristics of defense waste vitrification using liquid-fed Joule-heated ceramic melters. Goles, R.W.; Sevigny, G.J. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 237p. NTIS, PC A11/MF A01. Order Number DE84001019.

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Off-gas and effluent characterization studies have been established as part of a PNL Liquid-Fed Ceramic Melter development program supporting the Savannah River Laboratory Defense Waste Processing Facility (SRL-DWPF). The objectives of these studies were to characterize the gaseous and airborne emission properties of liquid-fed joule-heated melters as a function of melter operational parameters and feed composition. All areas of off-gas interest and concern including effluent characterization, emission control, flow rate behavior and corrosion effects have been studied using alkaline and formic-acid based feed compositions. In addition, the behavioral patterns of gaseous emissions, the characteristics of melter-generated aerosols and the nature and magnitude of melter effluent losses have been established under a variety of feeding conditions with and without the use of auxiliary plenum heaters. The results of these studies have shown that particulate emissions are responsible for most radiologically important melter effluent losses. Melter-generated gases have been found to be potentially flammable as well as corrosive. Hydrogen and carbon monoxide present the greatest flammability hazard of the combustibles produced. Melter emissions of acidic volatile compounds of sulfur and the halogens have been responsible for extensive corrosion observed in melter plenums and in associated off-gas lines and processing equipment. The use of auxiliary plenum heating has had little effect upon melter off-gas characteristics other than reducing the concentrations of combustibles.

55540 **(PNL-SA—11603) Geochemical modeling of uranium mill tailings: a case study.** Peterson, S.R.; Felmy, A.R.; Serne, R.J.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 29p. (CONF-8308118—1). NTIS, PC A03/MF A01. Order Number DE83017857.

From Annual geochemistry review; Washington, DC, USA (29 Aug 1983).

Liner failure was not found to be a problem when various acidic tailings solutions leached through liner materials for periods up to 3 y. On the contrary, materials that contained over 30% clay showed a decrease in permeability with time in the laboratory columns. The decreases in permeability noted above are attributed to pore plugging resulting from the precipitation of minerals and solids. This precipitation takes place due to the increase in pH of the tailings solution brought about by the buffering capacity of the soil. Geochemical modeling predicts, and x-ray characterization confirms, that precipitation of solids from solution is occurring in the acidic tailings solution/liner interactions studied. X-ray diffraction identified gypsum and alunite group minerals, such as jarosite, as having precipitated after acidic tailings solutions reacted with clay liners. The geochemical modeling and experimental work described above were used to construct an equilibrium conceptual model consisting of minerals and solid phases. This model was developed to represent a soil column. A computer program was used as a tool to solve the system of mathematical equations imposed by the conceptual chemical model. The combined conceptual model and computer program were used to predict aqueous phase compositions of effluent solutions from permeability cells packed with geologic materials and percolated with uranium mill tailings solutions. An initial conclusion drawn from these studies is that the laboratory experiments and geochemical modeling predictions were capable of simulating field observations. The same mineralogical changes and contaminant reductions observed in the laboratory studies were found at a drained evaporation pond (Lucky Mc in Wyoming) with a 10-year history of acid attack. 24 references, 5 figures 5 tables.

55541 **(SAND—83-0678) Comparison of waste emplacement configurations for a nuclear waste repository in tuff. II. Ventilation analysis.** Hickox, C.E. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1983. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01. Order Number DE84000976.

Ventilation requirements are assessed for three proposed nuclear waste emplacement schemes. The configurations investigated involve canisters of nuclear waste (1) placed periodically along the floor of a storage drift, (2) emplaced in vertical holes bored in the floor of a storage drift, and (3) emplaced in bored holes extending horizontally from the sides of an access drift. Preliminary analyses indicate that, for a drift wall temperature of 25°C, the maximum required cooling air velocity is slightly less than 1 m/s and occurs for configuration 1. The other two configurations require approximately one-half as much cooling air velocity, the exact value depending on the drift length. The associated frictional pressure loss is shown to be small. Estimates are made of the power required to reduce the temperature of the ambient air to levels suitable for effective cooling of the drifts. Based on the arrangements required for the storage of 1000 canisters, it is shown that configuration 1 requires the most refrigeration and configuration 3 the least. Finally, brief consideration is given to the physiological environment associated with the thermal energy released. Initial results indicate that it should be relatively easy to maintain an acceptable working environment.

55542 **(SAND—83-0757) Comparison of waste emplacement configurations for a nuclear waste respository in tuff. IV. Thermo-hydrological analysis.** Mondy, L.A.; Wilson, R.K.; Bixler, N.E. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1983. Contract AC04-76DP00789. 121p. NTIS, PC A06/MF A01. Order Number DE84000968.

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This report summarizes the results of a hydrological analysis of two emplacement schemes being considered for the storage of commercial high-level nuclear waste at the Nevada Test Site. The analysis is two-dimensional, considers the flow of water in partially saturated tuff (the Topopah Springs member of the Paintbrush tuff in Yucca Mountain) and includes the effects of the heat source (waste canisters) on that flow. The results include measures of the heat flux entering the access and emplacement drifts, measures of the flow rates near the canisters and a comparison of the temperature fields. It was necessary in the analysis to approximate the boundary conditions at the walls of the access and emplacement drifts in order to simulate the ventilation process. As a result the analysis was done for several cases which were expected to bracket the actual situation. A discussion of this problem is also included in the report. It should be noted that these results are intended as a means of comparing emplacement schemes, not as a performance assessment. 72 figures, 6 tables.

55543 **(UCRL—53442) Reaction of Bullfrog tuff with J-13 well water at 90°C and 150°C.** Oversby, V.M.; Knauss, K.G. (Lawrence Livermore National Lab., CA (USA)). 15 Sep 1983. Contract W-7405-ENG-48. 53p. NTIS, PC A04/MF A01. Order Number DE84000659.

A series of experiments was conducted on crushed tuff at 90°C and 150°C and on core wafer samples at 150°C. The results show the following: increasing the ratio of rock to water increases the rate of approach to steady-state concentrations in solution. Surface outcrop samples of Bullfrog tuff contain a minor component of highly soluble material believed to be a residue from the evaporation of surface runoff water in the pores of the rock. This material can be removed by shaking the crushed rock with water at room temperature and subjecting it briefly to heat with fresh water. Solution analyses for unfiltered samples that have reacted for short periods show higher concentrations of Al and Fe than do analyses for filtered samples; results for other elements are independent of filtration. This difference probably exists because of particulate matter in the solutions that dissolves when the samples are acidified prior to analysis. Agitation of samples during reaction produces sub-0.1 μ particles in the solutions. These particles dissolve when samples are acidified, resulting in abnormally high concentration values for some elements, such as Al and Fe. Comparison of the results for crushed rock with those for core wafers shows that the method of sample preparation does not have a large effect on the results of rock-water interaction studies.

55544 **(USGS-OFR—83-608) Geology of faults exposed in trenches in Crater Flat, Nye County, Nevada.** Swadley, W.C.; Hoover, D.L. (Geological Survey, Denver, CO (USA)). 1983. Contract AI08-78ET44802. 19p. NTIS, PC A02/MF A01. Order Number DE84000181.

Study of three trenches excavated across two faults along the eastern edge of Crate Flat indicates that the main fault move-

ment offset unit QTa in trench 1 at least 2.4 m down to the west, and occurred about 1.1 m.y. ago, as indicated by included basalt ash. Later fault movement, detected in trench 3, and probably related to the faulting at trench 1, displaced unit Q2c a combined distance of 0.8 m down to the west along three faults. Fault movement at trench 3 occurred sometime after 260,000 years ago and before about 40,000 years, but the evidence favors an age that is closer to the older date. 7 references.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 55496, 55499, 55501, 55506, 55527, 55528, 55531, 55537, 55538, 56329, 56524

55545 **(CONF-8308126—1-Draft) Evaluation of DOE radionuclide solubility data and selected retardation parameters: description of calculational and confirmatory experimental activities.** Kelmers, A.D.; Clark, R.J.; Cutshall, N.H.; Johnson, J.S.; Kessler, J.H. (Oak Ridge National Lab., TN (USA); Florida State Univ., Tallahassee (USA). Dept. of Chemistry). 1983. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84000731.

From NRC research annual review meeting; Reston, VA, USA (30 Aug 1983).

An experimentally oriented program has been initiated to support the NRC analysis and licensing activities related to high-level nuclear waste repositories. The program will allow the NRC to independently confirm key geochemical values used in the site performance assessments submitted by the DOE candidate repository site projects. Key radionuclide retardation factor values, particularly radionuclide solubility and sorption values under site specific geochemical conditions, are being confirmed. The initial efforts are being directed toward basalt rock/groundwater systems relevant to the BWIP candidate site in the Pasco Basin. Future work will consider tuff (NNWSI candidate site in Yucca Mountain) and salt (unspecified ONWI bedded or domal salt sites) rock/groundwater systems. Initial experimental results with technetium have confirmed the BWIP values for basalt/groundwater systems under oxic redox conditions: high solubility and no sorption. Under reducing redox conditions, however, the experimental work did not confirm the proposed technetium values recommended by BWIP. In the presence of hydrazine to establish reducing conditions, an apparent solubility limit for technetium of about 5E-7 mol/L was encountered; BWIP recommended calculated values of 1E-12 or greater than or equal to 1E-14 mol/L. Experimental evidence concerning sorption of reduced technetium species is incomplete at this time. Equilibrium speciation and saturation indices were calculated for well water data sets from BWIP using the computer code PHREEQUE. Oversaturation was indicated for hematite and quartz in all data sets. Near surface samples were undersaturated with respect to calcite, but most deep samples were oversaturated with respect to calcite and other carbonate minerals.

55546 **(LMF—102, pp 39-46) Aerosols from metal cutting techniques typical of decommissioning nuclear facilities - experimental system for collection and characterization.** Newton, G.J.; Hoover, M.D.; Barr, E.B.; Wong, B.A.; Ritter, P.D. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Decommissioning of radioactively contaminated sites has the potential for creating radioactive and other potentially toxic aerosols. We describe an experimental system to collect and characterize aerosols from metal cutting activities typical of those used in decommissioning of nuclear facilities. A special enclosure was designed for the experiment and consisted of a 5.1 cm x 10.2 cm stud frame with double walls of flame retardant polyethylene film. Large plexiglass windows allowed the cutting operations to be directed and filmed. Ventilation was 8500 liters/minute (300 CFM) exhausted through HEPA filters. Seven cutting techniques were evaluated: pipe cutter, reciprocating saw, band saw, chop saw, oxyacetylene torch, electric arc cut rod and plasma torch. Two grinding tools were also evaluated. Materials cut were 5.1 cm, 7.6 cm and 10.2 cm diameter schedule 40, 80 and 180 type 304L stainless steel pipe.

55547 **(RHO-RE-SR—83-24P) Results of the Separations Area ground-water monitoring network for 1982.** Wilbur, J.S.; Graham, M.J.; Lu, A.H. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Jul 1983. Contract AC06-77RL01030. 152p. NTIS, PC A08/MF A01. Order Number DE84000533.

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There were 107 wells in the 1982 Separations Area monitoring network. An additional network of wells in which water levels were measured was maintained in 1982. A calibrated ground-water flow model, generated for the Separations Area using water-level measurements, was used to predict water-level impacts of projected PUREX-related discharges on the unconfined aquifer. Water samples were collected monthly, quarterly, or semiannually from monitoring wells. During 1982, the ground-water monitoring schedule was updated to provide ground-water quality information prior to and after PUREX restart. An evaluation of 1982 monitoring data indicates few changes from 1981. In 1982, tritium analyses exceeded 300 pCi/mL (10% of Table II, DOE Order 5980.1, Chapter XI) in wells monitoring three active disposal sites. No other radionuclide contamination from active sites exceeded 10% of Table II guidelines. Nitrate results exceeded 45 mg/L (Environmental Protection Agency drinking water standards) in monitoring wells at two active sites. With the exception of tritium, radioactive contamination that exceeded 10% of Table II guidelines in 1982 was the result of inactive waste disposal operations. Average ^{90}Sr concentrations in monitoring wells around the 216-B-5 Reverse Well and 216-S-1 and S-2 Crib exceeded 0.03 pCi/mL, 10% of Table II, with the highest concentration equal to 9.45 pCi/mL. Average ^{137}Cs concentrations in monitoring wells near the 216-B-5 Reverse Well and 241-BX-102 Tank exceeded 0.2 pCi/mL, 10% of Table II, with a high of 3.61 pCi/mL. These zones of contamination appear to be localized near these inactive sites. Analysis of contamination plumes within the Separatioins Area indicated that contamination levels in ground water migrating out of the Separations Area at this time are less than DOE Table II guidelines.

0540 Health And Safety

REFER ALSO TO CITATION(S) 55492, 56350

55548 **(CONF-831174—1) Natural analogue approach for estimating the health risks from release and migration of radionuclides from radioactive waste.** Gilbert, T.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84000845.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The health risks from radioactive waste may be expressed as a sum of products of transfer factors that characterize the causal chain of events between disposal of radionuclides in a waste field and the consequent health effects. Model estimates for the transfer factors are commonly obtained by modeling transport and other mechanisms in the subsystems that form the links in the causal chain. Natural estimates of some conversion factors for naturally occurring radionuclides can be obtained from data on the concentrations of naturally occurring radionuclides in soil, food, and the human body. These model and natural estimates can be used with scaling procedures to estimate the uncertainties and to obtain better estimates of the values. The scaling procedures take into account the differences in the source characteristics for radionuclides in a waste field of limited size and for radionuclides generally distributed in the natural environment. The ratios of the natural estimates to the model estimates for several transfer factors and several radionuclides belonging to the U-238 decay series have been determined. These ratios range from 1/8 to 4/1 for food-concentration/source-concentration transfer factors for the food pathways and from 1 to 77 for dose-rate/source-concentration transfer factors for the internal radiation dose pathways to various organs. 14 references.

55549 **(NP—3903021) Radiation monitoring.** (Mine Safety and Health Administration, Denver, CO (USA). Denver Technical Support Center). 1979. 78p. NTIS, PC A05/MF A01. Order Number DE83903021.

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This general discussion of radiation and radioactivity as they relate to mines, particularly uranium mines, includes the following topics: general radiation discussion; radioactive minerals and related health hazards in mining; lung cancer among uranium and non-uranium miners; and radon daughters in mine air. (ACR)

55550 **(SAND—83-1296) Background radiation measurements at the Waste Isolation Pilot Plant (WIPP) Site, Carlsbad, New Mexico.** Minnema, D.M.; Brewer, L.W. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1983. Contract AC04-76DP00789. 49p. NTIS, PC A03/MF A01. Order Number DE84000975.

A series of background radiation measurements was performed at the Waste Isolation Pilot Plant (WIPP) Site, Carlsbad, New Mexico. The survey consisted of gross gamma and gamma spectral measurements of the radiation fields, soil and salt grab sample gamma analysis, and radon and working level measurements. The survey included locations at the surface and also within the mine itself. Background radiation levels on the surface were measured to average 7.65 microR/hour, and 0.7 microR/hour within the mine. Radon and working levels were at or below detection levels at all locations, and the radon concentration was estimated to be about 0.01 pCi/liter on the surface based on spectral measurements. The spectral measurements were performed using an intrinsic germanium spectrometer, and calculations from the spectra indicated that potassium-40 contributed about 28% to the surface level dose rates, natural uranium daughters contributed about 64%, and cesium-137 from weapons testing fallout contributed about 8%. In the mine potassium-40 was the only identifiable contributor to the dose rate.

0550 Regulations

55551 **(LA—9838-MS) Neutron production by alpha particles in thin uranium hexafluoride.** Stewart, J.E. (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01. Order Number DE84000125.

Alpha-particle-induced neutrons from UF_6 serve as an indicator of ^{235}U enrichment and may be exploited for safeguards purposes. If the UF_6 density is low enough, neutron production is reduced as a result of alpha-particle escape before (α,n) reactions with ^{19}F. Calculational methods and results are presented that enable prediction of neutron production in low-density (thin) UF_6 as encountered in the gas centrifugation method of uranium enrichment. Neutron production is shown to be strongly dependent on average UF_6 density and weakly dependent on rotational speed in an operating centrifuge.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

55552 **(CONF-8309127—1) Alternative isotope enrichment processes.** Terry, J.W. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE84000255.

From International Nuclear Target Society workshop; Argonne, IL, USA (7 Sep 1983).

Alternative processes such as gas centrifugation, plasma separation, and laser excited separation are evaluated for use at the ORNL Stable Isotope Enrichment Facility. The applicabiliy of each process to the isotopic enrichment of the calutron feed material and to the selective production of isotopes is determined. The process energy demands are compared to those of the existing facilities. The isotopic enrichment of the feed material prior to a first-pass through the calutrons can result in a significant saving in energy.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 56231

55553 (INIS-mf—8560, pp vp) **Use of radioactive implant in study of plasma etching.** Jech, C. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyzikalni Chemie a Elektrochemie J. Heyrovskeho). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8108164—Pt.1-Vol.2).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

Published in summary form only.

55554 **Radiation source shield and calibrator.** Christianson, C.L.; Spurlock, R. US Patent Application 6-467,727. [nd]. Filed date 18 Feb 1983. 10p.

This invention relates to a device for shielding a radiation source that is adapted to selectively position the source to be stored and shipped or positioned for repetitively establishing a radiation field for calibrating radiation detection devices.

0703 Isotopic Power Supplies

55555 **(MLM—3090) Milliwatt-generator heat source. Progress report, January-June 1983.** Mershad, E.A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 20 Sep 1983. Contract AC04-76DP00053. 14p. NTIS, PC A02/MF A01. Order Number DE84000518.

Progress is reported in the following: heat source shipments, reimbursable orders, hardware shipments, raw material qualification/procurement, DOE audit and milliwatt generator process review, surveillance capsule evaluations, pressure burst testing, and hardware fabrication and quality. (MHR)

08 HYDROGEN

REFER ALSO TO CITATION(S) 55812

0801 Production

REFER ALSO TO CITATION(S) 56167

55556 **(BNL—51695) Development of electrolysis-cell separator for 125°C operation. Advanced alkaline electrolysis cell development. Final report.** Murray, J.N. (Teledyne Energy Systems, Timonium, MD (USA)). Mar 1983. Contract AC02-76CH00016. 141p. NTIS, PC A07/MF A01. Order Number DE84000439.

This report contains the findings of a seven-month contracted effort. The major technical task involved a 125°C operating temperature test of the 20 v/o polybenzimidazole (PBI) - 80 v/o potassium titanate (K_2TiO_3) separator in combination with the nickel-molybdenum cathode electrocatalyst system dubbed the C-AN cathode using the ARIES test system which was developed previously. The test of the PBI-K_2TiO_3 separator was only partially successful. The anticipated 1.85 (75°C) and 1.75 volt per cell (100°C) input requirement at 550 ma/cm^2 were surpassed slightly. The test module operated stably for about 550 hr. Although there were some mechanical difficulties with the ARIES test unit, testing at 125°C proceeded from 745 hr on test until the test was terminated at 2318 operating hours to allow diagnostic disassembly. The input voltage degraded to a value of 1.82 volt per cell at 125°C which is unacceptable. Diagnostic disassembly showed the PBI portion of the separator was no longer present. PBI had been shown to be stable in 123°C, 45 w/o KOH solutions in a 1000-hr test. The attack is suggested to be attributable to a peroxide or perchlorate type oxidizer which would be unique to the electrolysis mode and probably not present in alkaline fuel cell applications. Recommendations for further testing include an evaluation of the chemical compatibility of PBI with alkaline/oxidizer solutions and endurance testing the C-AN cathode with new improved anode structures at 125°C using asbestos separators in combination with a silicate satu-

rated KOH electrolyte. Demonstration of the stability of this 1.65 volt per cell (90% voltage efficiency) technology at 500 ma/cm² will document an inexpensive and intelligent hydrogen production process which will satisfy the needs of the United States in the 1990s.

55557 **(EUR—8288EN) Electrolytic decomposition of water in fused hydroxides.** Divisek, J.; Malinowski, P.; Mergel, J. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 1983. 28p. Available from Commission of the European Communities, Luxembourg.

Thesis.

This report summarizes the initial results of the development and optimization of the electrolytic cell for producing hydrogen by means of water vapour electrolysis in molten hydroxides. The most important data relevant for the operation of this type of cell were determined. These are in particular the composition of melt, electrical conductivity, viscosity, water solubility, the water diffusion coefficient and corrosion data for the structural materials used. Furthermore, the electrochemical parameters of the electrolysis were also investigated. If pure molten NaOH is used as the electrolyte, then anodic peroxidic compounds result, in particular the superoxide O_2^-. This can be concentrated in the melt to a certain extent and then subsequently be cathodically reduced again so that decreases in current efficiency result. Moreover, these peroxides intensify anode corrosion. By adding LiOH or $Ba(OH)_2$ to the melt these two undesirable effects can be significantly decreased.

55558 **(EUR—8300EN) Development of an electrolytic cell for the anodic oxidation of sulphur dioxide and cathodic production of hydrogen for the sulphuric acid hybrid cycle.** Struck, B.D.; Neumeister, H.; Dujka, B.; Siebert, U.; Triefenbach, D. (Commission of the European Communities, Luxembourg. Directorate-General for Science, Research and Development). 1983. 36p. Available from Commission of the European Communities, Luxembourg.

With 31 figs.; 6 tabs.

A three-compartment electrolytic cell for the cathodic production of 10 l H_2/h and anodic oxidation of SO_2 was constructed scaling up a smaller cell producing about 1 l H_2/h. The cell operates at pressures up to 15 bar. Throughout a 600 h test run cell components remained stable except one gasket. The electrodes used were a graphite felt flow-through anode and a platinum layer deposited on a cation exchange membrane as cathode. Additionally, a cathode from tungsten carbide coated graphite was developed. Cell voltage increased by scaling up the electrolytic cell enlarging the single-electrode area from 10 to 125 cm². At 100 mA/cm² 600 mV instead of 500 mV and at 200 mA/cm² 800 mV instead of 600 mV were measured. The best voltage measured for the enlarged cell was 770 mV at 200 mA/cm². Improvements of cell voltage have to be mainly expected by improving activity and contacting of the cathode and by a better distribution of the anolyte flow through an extended anode.

55559 **(EUR—8480FR) Construction and characterization of an electrolyzer for the electrochemical reduction of water vapor at 850°C.** Viguie, J.C. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 1983. 43p. (In French). Available from Commission of the European Communities, Luxembourg.

A new planar cell for high temperature water electrolysis was fabricated, using a solid electrolyte disc made of yttria stabilized zirconia. The working area was 50 cm². The cell has been tested at 850°C. The previous gas tightness problems have been solved, but the thickness of the disc still remains the most critical parameter of this assembly technology: around 300 microns and below, an extensive cracking takes place, either during machining of the disc or in the course of the temperature test of the cell. The doping effect of cerium oxide at the cathodic interface has been studied on small size cells: due to the change of oxidation state of the cerium, the cathodic reactivity increases with decreasing water content in the gas mixture. A 50% increase of the hydrogen yield of serie connected tubular cells has been calculated. This electrochemical improvement brings a new interest to the tubular cells whose technology is more reliable.

55560 **Technological aspects of sulfur dioxide depolarized electrolysis for hydrogen production.** Lu, P.W.T. (Westinghouse Electric Corp., Pittsburgh, PA). *International Journal of Hydrogen Energy;* 8: No. 10, 773-781(1983).

Significant advancements in the SO_2-depolarized electrolysis technology have been obtained through a series of technical improvements in the electrode structure and cell configurations. Using carbon-supported platinum catalyst of loading 1 mg/cm², the currently achievable cell potentials are 680 and 910 mV at 200 and 400 mA/cm², respectively, in 50 w/o aqueous H_2SO_4 solution at 75°C and atmospheric pressure. To reduce further the electrical energy input for an SO_2-depolarized cell, major experimental efforts will be made to investigate the performance characteristics of pressurized electrolyzers. An advanced concept, using a solid oxide electrolyte, has been proposed for the electrochemical oxidation of gas-phase SO_3. Due to the elimination of aqueous electrolyte, this novel sulfur-based cycle is expected to result in a higher cycle efficiency and a lower corrosion environment than the conventional sulfur cycle hydrogen product process. 11 references, 9 figures.

55561 **Study of water vapor thermolysis in a cylindrical reactor.** Aziz, G.A.; Berlemont, A.; Puechberty, D.; Ledoux, M. (Faculte des Sciences et des Techniques de Rouen, France). *Annals of the New York Academy of Sciences;* 404: 457-460(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

The mechanisms (including chemistry and transports) of dissociation of water vapor in an electrically heated tubular reactor were investigated under low pressure (25 torr).

55562 **Water-binding reaction of the mercury-iodine thermochemical cycle ANL-4: precipitation of $KHCO_3$ from a purely aqueous medium.** Appelman, E.H.; Basile, L.J.; Richards, R.R.; Schreiner, F. (Argonne National Lab., IL). *International Journal of Hydrogen Energy;* 6: No. 3, 267-273(1981).

Yields and compositions of the products of the reaction $H_2O + NH_3 + CO_2 + KI \rightarrow KHCO_3 + NH_4I$ in aqueous solution are reported for the temperature range from 300 to 354 K. The effects of using pure water as a solvent for the water-binding reaction of the mercury-iodine thermochemical cycle ANL-4 are discussed. 4 references, 2 figures, 1 table.

55563 **Synfuel production in nuclear reactors.** Henning, C.D. US Patent Application 6-426,447. [nd]. 22p. Contract W-7405-ENG-48.

Apparatus and method for producing synthetic fuels and synthetic fuel components by using a neutron source as the energy source, such as a fusion reactor. Neutron absorbers are disposed inside a reaction pipe and are heated by capturing neutrons from the neutron source. Synthetic fuel feedstock is then placed into contact with the heated neutron absorbers. The feedstock is heated and dissociates into its constituent synfuel components, or alternatively is at least preheated sufficiently to use in a subsequent electrolysis process to produce synthetic fuels and synthetic fuel components.

0802 Storage

REFER ALSO TO CITATION(S) 56062, 56069

55564 **(EUR—7314EN) Hydride storage devices for load levelling in electrical power systems.** Buchner, H.; Schmidt-Ihn, E.; Kliem, E.; Lang, U.; Scheer, U. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 1983. 135p. Available from Commission of the European Communities, Luxembourg.

The use of metal hydrides for the storage of hydrogen is investigated, and both technical and economic aspects of using large stationary storage devices for electrical load levelling are discussed. Two storage capacities, 100 MWh (32,000 m³ of H_2) and 1000

MWh (320,000 m^3 of H_2) are considered, and the units are based on low-temperature Ti, Cr, Mn hydrides, which can usefully store 2% hydrogen by weight. The thermodynamics, thermal conductivities, and kinetics of the hydrides were investigated and a method of improving their low thermal conductivity, through the addition of a metal powder, was developed. In the practical design, an eight hour period was assumed for each of the three stages, absorption, storage and desorption, and heat flow was found to be the dominant rate limiting factor. Details are presented of two different design options, with either a steel or a concrete outer jacket, and with the hydrogen storage pressure assumed to be either 10 or 55 bars. Depending on the capacity of the final installation, the storage system consists of two or twenty sub-units, each with a hydrogen capacity of 16,000 m^3. Several possibilities for the siting of the storage devices are suggested and their relative advantages and disadvantages are discussed. The capital and running costs of four hydride storage systems are presented, and a cost comparison with other methods of storing hydrogen shows that hydride storage is more economical than either the cryogenic liquid hydrogen or pressurised gas approaches.

55565 **(Juel—1800) Tritium in metals: Techniques of preparation.** Laesser, R.; Klatt, K.H.; Mecking, P.; Wenzl, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Aug 1982. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83751235.

In order to study the behavior of tritium in metals, an all metal apparatus has been built for the safe handling of 100 mg of tritium. Samples of palladium, vanadium, niobium, and tantalum were loaded with tritium, deuterium or hydrogen. Some details of the phase diagrams could be established by DTA and by measurement of the lattice parameters. The diffusion of tritium in V, Nb, and Ta was studied with the Gorsky-effect.

55566 **Diffusion behavior in titanium-chromium hydrides.** Bowman, R.C. Jr. (Monsanto Research Corp.-Mound, Miamisburg, OH); Craft, B.D.; Attalla, A.; Johnson, J.R. *International Journal of Hydrogen Energy;* 8: No. 10, 801-808(1983).

NMR measurements of the proton relaxation times T_1, T/sub 1 rho/, and T_2 have been performed on the low (i.e. α-phase) and intermediate (i.e. α-phase) hydrogen concentrations in CO-stabilized $TiCr_2H_x$ with both the hexagonal (C14) and cubic (C15) Laves structures. The relaxation times indicate rapid proton diffusion above 200 K for all the $TiCr_2H_x$ phases; however, large differences in the diffusion activation energies are observed. This behavior is structure sensitive and has been associated with variations between interstitial site occupancies and diffusion pathways for the C15 and C14 structures. The estimated 300 K diffusion constants in the α-phase of $TiCr_2H_x$ are comparable to the literature values for $HfV_2H_{2.1}$, $LaNi_5H_{6.5}$ and $PdH_{0.70}$ but are orders of magnitude larger than the proton diffusion constant in $TiFeH_{1.0}$. 31 references, 8 figures, 2 tables.

55567 **Long-term testing and stability of $CaNi_5$ alloy for a hydrogen storage application.** Bawa, M.S.; Ziem, E.A. (Texas Instruments Inc., Dallas). *International Journal of Hydrogen Energy;* 7: No. 10, 775-781(1982).

$CaNi_5$ alloy in a long-term test in excess of 5000 charge/discharge cycles demonstrated good stability. The hydrogen absorption was in the 20 to 40°C range at hydrogen pressures of 1.07 to 1.35 atm. The hydrogen desorption in the 50 to 60°C range was at 1.14 to 2.36 atm. A hydrogen working capacity under the above test conditions of ca 0.8% by weight was obtained.

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 55873

0901 Hydrocarbon Fuels

55568 **(BMFT-FB-T—83-168) Design and construction of a bio-gasification plant for the supply of a farm, - that produces and refines agricultural products -, with energy and biodung.** Brand, R.A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1983. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83751345.

The design and construction of a biogas plant for demonstration purposes is discussed. Total fermenter volume is 2 x 500 m^3, suited for mesophilic and thermophilic anaerobic digestion and for parametric experiments with substrates of various composition. A two phase bioreactor, pH-static, is near automatic operational mode. Production of biodung, biogas, electric energy and heat is discussed. Some features of the bioreactor are: 11,5 bar pressure-storage of biogas, compression heat recovery, use of isothermic gas expansion for cooling purposes, recovery of sludge heat in counter flow heat exchangers, collection of post-fermentation gas, and utilization of stack gas from the energy conversion process.

55569 **(DOE/RA/50304—T1-Vol.1) Feasibility study for alternate fuels production: unconventional natural gas from wastewater treatment plants. Volume I. Technical results.** Overly, P.; Tawiah, K. (Acurex Corp., Mountain View, CA (USA). Alternate Energy Div.). Dec 1981. Contract FG01-80RA50304. 150p. NTIS, PC A07/MF A01. Order Number DE83018206.

Results of a study to determine the feasibility of recovery, distribution and scrubbing of digester gas at wastewater treatment plants are reported. Data indicate that: excess digester gas can be used fully and cost effectively at the wastewater treatment plant; distribution, including gas cleanup and the necessary distribution interface network, can be complex and costly; and a significant portion of plant operators prefer onsite use, given its relative simplicity and potential to displace costly conventional fuels. 15 figures, 20 tables.

55570 **(DOE/RA/50304—T1-Vol.2) Feasibility study for alternate fuels production: unconventional natural gas from wastewater treatment plants. Volume II, Appendix D. Final report.** Overly, P.; Tawiah, K. (Acurex Corp., Mountain View, CA (USA). Alternate Energy Div.). Dec 1981. Contract FG01-80RA50304. 216p. NTIS, PC A10/MF A01. Order Number DE83017921.

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Data are presented from a study performed to determined the feasibility of recovering methane from sewage at a typical biological secondary wastewater treatment plant. Three tasks are involved: optimization of digester gas; digester gas scrubbing; and application to the East Bay Municipal Utility District water pollution control plant. Results indicate that excess digester gas can be used economically at the wastewater treatment plant and that distribution and scrubbing can be complex and costly. (DMC) 193 references, 93 figures, 26 tables.

55571 **(PNL—4779) 1982 annual report: Biomass Thermochemical Conversion Program.** Schiefelbein, G.F.; Stevens, D.J.; Gerber, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 85p. NTIS, PC A05/MF A01. Order Number DE84000580.

This report provides a brief overview of the Thermochemical Conversion Program's activities and major accomplishments during fiscal year 1982. The objective of the Biomass Thermochemical Conversion Program is to generate scientific data and fundamental biomass conversion process information that, in the long term, could lead to establishment of cost effective processes for conversion of biomass resources into clean fuels and petrochemical substitutes. The goal of the program is to improve the data base for

biomass conversion by investigating the fundamental aspects of conversion technologies and exploring those parameters which are critical to these conversion processes. To achieve this objective and goal, the Thermochemical Conversion Program is sponsoring high-risk, long-term research with high payoff potential which industry is not currently sponsoring, nor is likely to support. Thermochemical conversion processes employ elevated temperatures to convert biomass materials into energy. Process examples include: combustion to produce heat, steam, electricity, direct mechanical power; gasification to produce fuel gas or synthesis gases for the production of methanol and hydrocarbon fuels; direct liquefaction to produce heavy oils or distillates; and pyrolysis to produce a mixture of oils, fuel gases, and char. A bibliography of publications for 1982 is included.

55572 **(SERI/TP—234-1964) Biomass gasification reaction velocities.** Reed, T.B.; Markson, M. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1983. Contract AC02-77CH00178. 28p. (CONF-821051—6). NTIS, PC A03/MF A01. Order Number DE84000010.

From International conference on fundamentals of thermochemical biomass conversion; Estes Park, CO, USA (18 Oct 1982).

The propagation of gaseous flames is determined by the flame velocity, V/sub f/ (the rate at which the flame propagates into the unburned fuel/oxidant). In the same way, gasification of solid fuels depends on the gasification reaction velocity (V/sub r), the rate at which the reaction interface can move into the unreacted solid fuel. We have developed a simple laboratory transparent downdraft gasifier for measuring this velocity for a variety of fuels and conditions. Air or oxygen is drawn down through a 5-cm-diameter quartz tube. If the reaction zone remains stationary in the tube, V/sub r/ is simply the volumetric feed rate. For some input conditions, the position of the incandescent reaction zone is quite stable in the quartz tube. This position depends on the relative rates of production of charcoal by pyrolysis of the biomass and gasification of the charcoal by the pyrolysis combustion gases and can move up or down, depending on conditions. In an uninsulated tube the zone may move down indicating that the char gasification rate exceeds the pyrolysis rate. Adding insulation to the tube increases the tendency for the zone to move up, indicating that the pyrolysis rate is faster than the gasification rate. In practical gasifiers it is necessary to stabilize the reaction front such that the propagation rate equals the feed rate. A number of methods of stabilizing this front have been found. We believe the data and observations presented here help form the basis for a model of downdraft biomass gasification which is significantly different from previous models, and we are continuing to gather data for this model.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 55385, 56193, 56307

55573 **(CONF-820993—2-Draft) Fluidized-bed bioreactors using a flocculating strain of Zymomonas mobilis for high-productivity ethanol fermentation.** Scott, C.D. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01. Order Number DE84000207.

From Biochemical engineering conference; Santa Barbara, CA, USA (20 Sep 1982).

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The flocculating strain of Zymomonas mobilis (NRRL B-12526) has been shown to form stable floc particles that can effectively convert glucose to ethanol at rates in excess of 400 g/L.h in a fluidized-bed bioreactor. The system is so reactive that the CO_2 off-gas makes it difficult to maintain high biomass loading in the upper part of the reactor, thus, resulting in a reduced ethanol productivity that approaches 100 g/L.h for the entire active reactor volume when over 95% of the glucose is metabolized. An increase in biomass loading and the use of a glucose feed concentration in excess of 150 g/L will undoubtedly result in even high levels of ethanol productivity. 12 references, 6 figures, 2 tables.

55574 **(DOE/CS/54045—2) Assessment of ether and alcohol fuels from coal. Volume 2. Technical report.** (Suntech, Inc., Marcus Hook, PA (USA). Applied Research Dept.). Mar 1983. Contract AC04-78CS54045. 400p. NTIS, PC A17/MF A01. Order Number DE83017920.

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A unique route for the indirect liquefaction of coal to produce transportation fuel has been evaluated. The resultant fuel includes alkyl tertiary alkyl ethers and higher alcohols, all in the gasoline boiling range. When blended into gasoline, the ether fuel provides several advantages over the lower alcohols: (1) lower chemical oxygen content, (2) less-severe water-separation problems, and (3) reduced front-end volatility effects. The ether fuel also has high-octane quality. Further, it can be utilized as a gasoline substitute in all proportions. Production of ether fuel combines several steps, all of which are or have been practiced on an industrial scale: (1) coal gasification, (2) gas cleanup and shift to desired H_2:CO ratio, (3) conversion of synthesis gas to isobutanol, methanol, and higher alcohols, (4) separation of alcohols, (5) chemical dehydration of isobutanol to isobutylene, and (6) etherification of isobutylene with methanol. A pilot-plant investigation of the isobutanol synthesis step was performed. Estimates of ether-fuel manufacturing costs indicate this process route is significantly more costly than synthesis of methanol. However, the fuel performance features provide incentive for developing the necessary process and catalyst improvements. Co-production of higher-molecular-weight co-solvent alcohols represents a less-drastic form of methanol modification to achieve improvement in the performance of methanol-gasoline blends. Costs were estimated for producing several proportions of methanol plus higher alcohols from coal. Estimated fuel selling price increases regularly but modestly with higher alcohol content.

55575 (NP—3770372, pp 17-46) **Sub-project A2: Elementary reactions in C/sub x/H/sub y combustion.** Just, T.; Grotheer, H.H.; Meier, U. 1982. (In German). NTIS (US Sales Only), PC A99/MF A01.

In SFB 85 - progress report for the years 1980/81/82.

Measurements of methanol elementary reactions are particularly sensitive to secondary reactions. In the case of the H_3COH-O-system this has been considered in an extensive reaction model. Thereby, questions arose, which have to be studied experimentally. Nevertheless, the velocity coefficient of the primary reaction $H_3COH + O$ has been obtained with sufficient precision from experimental data, using this model. The results are in essential disagreement with other publications and may be of interest in the formulation of models describing methanol flames. An apparatus is described for the study of the reaction $H_3COH + OH$ by laser-induced fluorescence, with the aid of which experiments can be performed, which to a large extent are free of secondary reactions. In the case of methanol, however, also with this set-up specific problems occured, which are presumably caused by secondary reactions induced by the fast reaction of H with hydroxyl methyl. The temperature dependence of the velocity coefficient could be determined after an appropriate change of the measuring conditions. The mass spectrometer flow reactor has been modified to allow for the production and detection of H_3COH radicals. According to the present findings, this radical reacts very slowly with O_2, a result which may be important for the chemistry of the atmosphere. Finally a study has been initiated of reactions between the H_3COH radical and other radicals. In particular the reaction with hydrogen atoms seems to be promising.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 55588

13 HYDRO ENERGY

55576 **(EGG-M—02983) Recent DOE-sponsored hydropower engineering research.** Chappell, J.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 10p. (CONF-830939—2). NTIS, PC A02/MF A01. Order Number DE84000809.

From Waterpower '83 - international conference on hydropower; Knoxville, TN, USA (18 Sep 1983).

Purpose of this paper is to provide an overview of DOE Engineering Development research activity since Waterpower 1981. General results of about 11 projects that have been completed since Waterpower 1981 are presented and compared. Continuing efforts are also described briefly. DOE has sponsored four projects dealing with the use of pumps as turbines. This approach results in capital cost savings, shorter time for completing a hydropower plant, wider variety of off-the-shelf equipment available, and better maintenance services. Results are summarized for feasibility studies, laboratory tests, and in-the-field experience surveys of the use of pumps as turbines. Other projects discussed include microhydropower plants (less than 100 kW in capacity), head augmentation devices, Schneider engines, the use of marine thrusters as turbines, low cost cross-flow turbines made of plastic, variable speed constant frequency generators, hydraulic air compressors, scroll motor turbines and modular float-in powerhouses. The paper also discusses some of the technologies where future research may prove fruitful.

55577 **(EGG-M—16683) Small hydropower technology transfer project.** Cunningham, C.; Christensen, J.; Engebretsen, A.R.; Sommers, G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 11p. (CONF-830939—1). NTIS, PC A02/MF A01. Order Number DE84000808.

From Waterpower '83 - international conference on hydropower; Knoxville, TN, USA (18 Sep 1983).

Since its inception in 1977, the National Small Hydropower Program has supported investigations of 253 small scale hydropower projects and implementation of 20. The first draft of the summary document covering feasibility studies has been completed and the results of the analysis are summarized within this paper.

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 55580, 55581

55578 **(DOE/EIA—0171(81)) Hydroelectric plant construction cost and annual production expenses - 1981.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Aug 1983. 123p. NTIS, PC A06/MF A01 - GPO. Order Number DE84000243.

This report shows the investment cost of hydroelectric plants and the cost (exclusive of annual fixed costs) to electric utilities to produce electric power, with water as the primary energy source, using a group of reporting plants located in the United States. The publication contains data on installed generating capacity, net generation, net capability, cost of plant, production expenses, and hydraulic features for all such plants. The publication is composed of detailed tabular data for each plant. The table is arranged alphabetically by state, utility (operating company), and plant.

1304 Regulations And Licensing

55579 **(PB—83-221739) Manual for developing small-scale and micro-hydropower plants in Idaho: A guide to permits, licenses, and incentives.** Warnick, C.C. (Idaho Univ., Moscow (USA). Dept. of Civil Engineering). Mar 1983. 120p. NTIS, PC A06/MF A01.

The manual has been prepared to assist potential developers of hydropower and to help agency personnel concerned with hydropower, planning and development in Idaho. It is designed to guide the developer through the various steps in preparing a feasibility study and completing the necessary licensing. The manual gives brief information on the engineering requirements and the economic analysis and references as to how to obtain necessary professional assistance.

1305 Economics And Management

55580 **(AD-A—129707/6) Lock and Dam 5, Mississippi River near Minneiska, Minnesota, Reconnaissance report for hydropower. Preliminary report.** (Corps of Engineers, St. Paul, MN (USA). St. Paul District). Sep 1981. 117p. NTIS, PC A06/MF A01.

This report presents a preliminary evaluation of the addition of hydropower at the existing navigation Lock and Dam 5. The study shows that installation of a hydroplant with a 6,000-kW (kilowatt), 8,400-kW, or 10,800-kW nameplate rating is economical. Pertinent data concerning the site and potential hydropower installations are given. Severe environmental impacts are not necessarily associated with construction of a plant of the sizes investigated despite the proxity of the lock and dam to an environmentally sensitive area. The District Engineer recommends that the Corps of Engineers prepare a feasibility report which can serve as a basis for congressional authorization for hydropower plant construction at lock and dam 5.

55581 **(AD-A—129708/4) St. Anthony Falls locks and dams, Mississippi River, Minneapolis, Minnesota. Reconnaissance report for hydropower. Preliminary report.** (Corps of Engineers, St. Paul, MN (USA). St. Paul District). Sep 1981. 161p. NTIS, PC A08/MF A01.

This report presents a preliminary evaluation of the additional hydropower potential at both Upper and Lower St. Anthony Falls. Two existing hydropower plants owned and operated by Northern States Power Company generate at nameplate capacities of 12.4 Mw (megawatt) and 8.0 MW at Hennepin Island (Upper St. Anthony Falls) and Lower Dam (Lower St. Anthony Falls), respectively. The study shows that incremental added capacity of up to 15.0 Mw at Hennepin Island and 8.4 Mw at Lower Dam is economical. pertinent data concerning the sites are given. Severe environmental impacts do not appear to be associated with construction of plants of the sizes investigated. The District Engineer recommends that the Corps of Engineers prepare a feasibility report which can serve as a basis for congressional authorization for hydropower plant(s) construction at St. Anthony Falls.

1306 Environmental Aspects

55582 **(FERC/EIS—0037) Eagle Rock Hydroelectric Project, FERC No. 2789 - Idaho. Draft environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Aug 1983. 193p. NTIS, PC A09/MF A01. Order Number DE83017628.

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The Raft River Rural Electric Cooperative, Inc. proposes to construct a hydroelectric project with a total installed capacity of 47.8 megawatts (MW) on the Snake River in the vicinity of American Falls, Idaho. It is concluded that the proposed Eagle Rock Project would unavoidably impact the present resources and uses of the project reach of the Snake River. The loss of 4.7 miles of free-flowing river, the loss of natural reaeration, and the loss of a Class I trout fishery, which Staff considers irreplaceable, would not be fully mitigated. Whitewater boating would be eliminated; bald eagle and waterfowl use of the project reach would be restricted; the loss of riparian communities would reduce wildlife populations; and prehistoric and historic resources would be impacted significantly. Energy surpluses in the Pacific Northwest are predicted from 1987 until the early 1990's, when energy deficits are expected. Staff's analysis shows that, if the proposed project becomes operational in 1987, the operation would not be economical, and if energy surpluses in the Pacific Northwest continue, the Applicant would have to sell project power at a price less than the cost of generation.

14 SOLAR ENERGY

55583 (DOE/IR/10037—T6) Module eight: solar energy. (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 35p. NTIS, PC A03/MF A01. Order Number DE84000236.

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This module covers historical, present and projected future use of solar energy to directly heat, cool and provide electrical power for homes and industry. It includes a detailed outline keyed to viewgraphs and suggested topics for discussion. This module could be presented in any science class and, ideally, should be included in a class on heating and air conditioning. This module should be presented by an instructor qualified to answer questions pertaining to the material. The objective of this module is to provide the student with an understanding of the nature of solar energy, and the devices and techniques presently being used to capture this energy. It should enable the students to make some decisions in applying solar energy to their own homes and in supporting legislation that can affect its use and development. Eleven black and white master illustrations are included which may be reproduced for hand-out by the instructor, or made into transparencies for visual presentation.

1401 Resources And Availability

REFER ALSO TO CITATION(S) 55618

1403 Economics

55584 (UAH—375) Research and support of SOLCOST and solar technical services centers. Final report. Weir, S.B. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Jun 1983. Contract FG01-79CS30013. 26p. NTIS, PC A03/MF A01. Order Number DE84000251.

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The objective and scope of the research activity was to compile current utility rates, both residential and commercial, for the 315 sites in the SOLCOST Data Bank (and others upon request) and to present these in several reference documents. These rates included electricity, natural gas, No. 2 fuel oil and coal. Computer programs were developed to compile, manipulate, and print the data. Information provided included state, city, date, company, address, customer charge, minimum charge, fuel adjustment charge, and taxes. It also included surcharges, other charges, the basic rate structure, and calculations for cost. The calculations included totals without charges and taxes, totals with charges and taxes, cost per unit and cost per million Btu. The cost comparison documents included population, annual heating and cooling degree days, mean daily solar radiation in Btu per square foot; cost per ton of coal, cost per 1000 kWh of electricity, cost per 10,000 cubic feet of natural gas, and cost per gallon of No. 2 fuel oil. Averages for each state, the regions of the four solar energy centers, the nine DOE regions and the United States were also provided. Rankings by cities and states in both descending and alphabetical order and related graphics were incorporated. A buy back rate listing was also prepared showing rates paid to small power producers and cogenerators.

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 55588

55585 (MTR—80W00019) Toward a national plan for the accelerated commercialization of solar energy. Workbook summaries. Gerstein, R.E.; Kannan, N.P.; Miller, C.G.; Shulman, M.J.; Taul, J.W. Jr.; de Jong, D.L. (Mitre Corp., McLean, VA (USA)). Jan 1980. Contract AC01-78CS35147. 39p. NTIS, PC A03/MF A01. Order Number DE83017957.

These workbooks contain preliminary data and assumptions used during the preparation of inputs to a National Plan for the Accelerated Commercialization of Solar Energy (NPAC). The workbooks indicate the market potential, competitive position, market penetration, and technological characteristics of solar technologies over the next twenty years for five market sectors: residential buildings; commercial and institutional buildings; agricultural and industrial process heat; utility applications; and synthetic fuels and chemicals. The workbooks also present projections of the mix of solar technologies by US Census Region. In some cases, data have been aggregated to the national level. Emphasis of the workbooks is on a mid-price fuel scenario, Option II, that meets about a 20 percent solar goal by the year 2000. The energy demand for the mid-price scenario is projected at 115 quads in the year 2000.

55586 (NP—3770381) German Solar Energy Industries Association. Companies associated. (Bundesverband Solarenergie, Essen (Germany, F.R.)). [nd]. 12p. (In German, English, French, Spanish, Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770381.

This information brochure of the Bundesverband Solarenergie (BSE) contains a list of firms associated with this organization.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 55571, 55572, 55573, 56171, 56307

55587 (BNL—33439) Effect of silane fraction on the optoelectronic and photovoltaic properties of RF-glow-discharge a-Si:H prepared from $SiH_4 + H_2$ mixtures. Rajeswaran, G.; Vanier, P.E.; Kampas, F.J.; Corderman, R.R.; Wiesmann, H. (Brookhaven National Lab., Upton, NY (USA); H. T. Products, Inc., Yonkers, NY (USA)). 1983. Contract AC02-76CH00016. 5p. (CONF-830895—8). NTIS, PC A02/MF A01. Order Number DE83016730.

From 10. international conference on amorphous and liquid semiconductors; Tokyo, Japan (22 Aug 1983).

The properties of films grown from SiH_4H_2 mixtures were systematically investigated. The hydrogen content, band gap, dark conductivity, and photoconductivity were measured as a function of SiH_4 fraction. Solar cells were fabricated from 10 and 25% mixtures.

55588 (BNL—33613) Health and safety considerations in solar and biomass deployment. A report on aspects of the TASE project. Lipfert, F.W. (Brookhaven National Lab., Upton, NY (USA)). Jul 1983. Contract AC02-76CH00016. 17p. NTIS, PC A02/MF A01. Order Number DE83018289.

As an element of the Technology Assessment of Solar Energy, the fuel requirements for biomass energy systems and the material requirements for solar energy systems were developed for high and low growth scenarios. The low growth scenario projected 3 quads each for biomass and solar systems (1 quad = 10^{15} Btu); the high growth scenario projected 5.7 quads for biomass and 8.5 quads for solar energy, all for the year 2000. This paper presents general conclusions and supporting data regarding public and occupational health and safety aspects of such incremental growth. It is shown that uncontrolled biomass combustion and, in particular, use of residential firewood, present risks that should be considered in developing energy policies that would encourage these technologies. In contrast, no extraordinary or unique hazards were found in assessing solar technologies.

55589 (CONF-820906—39) Studies of grain boundaries in small-grained polycrystalline silicon solar cells. Young, R.T.; van der Leeden, G.A.; Wood, R.F.; Narayan, J. (Oak Ridge National Lab., TN (USA); Helionetics, Inc., San Diego, CA (USA)). 1982. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84000682.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

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Progress in the development of small-grained (10 to 100 μm) polycrystalline Si solar cells is hampered by the present poor knowledge of physical and chemical properties of grain boundaries and the lack of satisfactory processing techniques for junction formation. In the work discussed in this paper we have studied grain boundaries and their effects in polycrystalline silicon with grain

sizes of 1 to 2 mm and in smaller grained material with grain sizes of 10 μm and 40 to 50 μm. Results for various recombination effects observed in the large-grained material are described and the influence of lithium passivation on the electrical properties of the small-grained material and on the characteristics of solar cells made from it are reported.

55590 **(CONF-820906—40) Update of pulsed-laser processing technology for high-efficiency silicon solar cells.** Young, R.T.; van der Leeden, G.A.; Wood, R.F.; Westbrook, R.D. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84000638.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Recent advances in the pulsed laser processing of silicon solar cells are described. These include the use of a XeCl laser to avoid the need for the beam homogenizers and substrate heating used with solid state lasers, the further development of low-cost gaseous discharge implantation equipment, and the use of P-diffusion for back surface field formation instead of laser damage gettering followed by laser-induced diffusion of antimony.

55591 **(DOE/ER/30029—T1) Photovoltaic-cell-research priorities.** Bornstein, J.G.; Hien, L.K.; Silberglitt, R. (DHR, Inc., McLean, VA (USA)). 30 Sep 1983. Contract AC01-82ER30029. 152p. NTIS, PC A08/MF A01. Order Number DE84000066.

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The current state of research and development on photovoltaic materials and advanced concepts are reviewed, and priority research activities for improved photovoltaic cells in the major individual research areas (i.e., silicon, III-V materials, II-VI materials) are identified. Also noted is the importance of reserving a small but finite portion of photovoltaic research funding for out-of-the-mainstream research. The major features of a research management philosophy aimed at attracting the best available scientific resources and research capabilities to photovoltaic research and development are outlined. The priority research activities in the principal areas of photovoltaic research are then summarized and compared, and the overall conclusions of the assessment are presented. (LEW)

55592 **(DOE/ET/20587—T2) Application of sugar maple and black locust to the biomass/energy plantation concept. Interim report, March 1, 1980-February 28, 1981.** (Michigan Technological Univ., Houghton (USA). Dept. of Forestry). 1 Mar 1981. Contract FG01-78ET20587. 45p. NTIS, PC A02/MF A01. Order Number DE84000238.

The objective of the research program is to determine the feasibility of converting existing pole-size maple stands to biomass/energy plantations using black locust as an interplanted species. Toward this end, progress has been made in quantifying sprout biomass. Significant differences have been identified in productivity by site, species, time of fertilizer application, and diameter and damage of stumps. Rhizobium strains for black locust have been identified which are tolerant of low pH and phosphorous and high aluminum levels. Frost-hardy black locust seed sources have been identified for future work. Methods for sampling and equations for young natural stands of maple have been developed. Detailed characterization of sugar and red maple sprouts by physical, chemical and thermal analysis were compared to those of old, mature trees. The results are discussed in terms of seasonal moisture content variation, effects of tree age on specific gravity, extractive contents, ash content, major cell wall components, heating values and thermal behavior. 7 references, 5 figures, 17 tables.

55593 **(DOE/ET/23109—T1) Electrochemical characterization of polycrystalline thin films for solar cells. Final report, 3 July 1979-2 July 1980.** Morrison, S.R.; Loo, B.H.; Madou, M.H.; Frese, K.W. Jr. (SRI International, Menlo Park, CA (USA)). 8 Jul 1980. Contract AC01-79ET23109. 47p. NTIS, PC A03/MF A01. Order Number DE83018236.

A brief review of the band model at the silicon/aqueous-electrolyte interface is given, followed by a discussion of sample preparation techniques. The development of techniques for measurement of doping level and diffusion length are discussed. These measurements need an electrolyte capable of capturing holes but not injecting carriers. A major thrust reported has been the preliminary examination of current flow between grain boundaries and ions in solution. Some information has been generated about energy levels at grain boundaries. The controlled flow of current through the grain boundaries to an electrolyte may offer the possibility of preferred deposition of metals at grain boundaries for passivation purposes. (LEW)

55594 **(DOE/JPL/955843—83/11) Large-area sheet task advanced dendritic: web-growth development. Quarterly report, April 1-June 30, 1983.** Duncan, C.S.; Seidensticker, R.G.; McHugh, J.P. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 8 Sep 1983. Contract NAS-7-100-955843. 45p. NTIS, PC A03/MF A01. Order Number DE84000637.

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The validity of the use of a finite ribbon segment (finite element mesh) to represent the properties of a semi-infinite ribbon (web crystal), particularly as the ribbon width becomes a large fraction of the mesh length, was examined in detail. Areas where the buckling model might be improved are suggested. Experimentally, the area throughput goals for transient growth of 30 and 35 cm^3/min were met and exceeded. A dynamic growth configuration demonstrated a 42% improvement in growth velocity over the equivalent static configuration.

55595 **(EUR—7541FR) Stabilization of the photoactive complexes between pigments and proteins.** Sironval, C.; Collard, F.; Jeanfils, J. (Commission of the European Communities, Luxembourg. Directorate-General for Science, Research and Development). 1982. 66p. (In French). Available from Commission of the European Communities, Luxembourg.

The authors have attempted to stabilize plasts or photoactive membrane fractions by establishing bridges between reactive groups in the proteins of the chlorophyll/lipoprotein pigment complexes. Preliminary studies have suggested that glutaraldehyde is the most promising substance for this purpose.

55596 **(N—8323702) Low cost solar array project. Cell and module formation research area. Process research of non-CZ silicon material.** (Westinghouse Electric Corp., Pittsburgh, PA (USA); Jet Propulsion Lab., Pasadena, CA (USA)). 1983. 34p. (NASA-CR—170241; JPL—9950-816). NTIS, PC A03/MF A01.

Liquid diffusion masks and liquid dopants to replace the more expensive CVD SiO2 mask and gaseous diffusion processes were investigated. Silicon pellets were prepared in the silicon shot tower and solar cells were fabricated using web grown where the pellets were used as a replenishment material. Verification runs were made using the boron dopant and liquid diffusion mask materials. The average of cells produced in these runs was 13%. The relationship of sheet resistivity, temperature, gas flows, and gas composition for the diffusion of the P-8 liquid phosphorus solution was investigated. Solar cells processed from web grown from Si shot material were evaluated, and results qualified the use of the material produced in the shot tower for web furnace feed stock.

55597 **(N—8323703) Design, analysis and test verification of advanced encapsulation systems.** Garcia, A., III. (Jet Propulsion Lab., Pasadena, CA (USA)). Feb 1983. 20p. (NASA-CR—170240; JPL—9950-817). NTIS, PC A02/MF A01.

A preliminary reduced variable master was constructed for pressure loading. A study of cell thickness versus cell stress was completed. Work is continuing on encapsulation of qualification modules. A 4 ft x 4 ft 'credit card' construction laminate was made.

55598 **(NP—3770370) Automation of bioreactors.** Fitzner, U. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Lebensmitteltechnologie und Biotechnologie). 10 Dec 1979. 467p. (In German). NTIS (US Sales Only), PC A20/MF A01. Order Number DE83770370.

Portions are illegible in microfiche products; Thesis.

In the paper at hand the literature discussing the automation of bioreactors has been summarized and analysed. The problems posed by the automation of bioreactors have not yet been solved sufficiently. A variety of causes is responsible for that, such as the unsolved problems of measurement technique, the mostly heterogeneous composition of substances, living microorganisms and their special features, and how those processes take place which differ from one another according to the product involved. The nonlinear dynamic behaviour of fermenting processes makes setting-up mathematical models difficult. Fully-automated processes on an industrial scale are not known according to investigation made in literature. Therefore the same, patent-based importance has not yet been attached to the automation potential existing in the field of biotechnology as has been to the one of other fields of process engineering.

55599 **(SAND—83-7021) Cell-substrate bonding system design and development.** Marshall, L.S. (Martin Marietta Corp., Denver, CO (USA). Denver Aerospace). Aug 1983. Contract AC04-76DP00789. 99p. NTIS, PC A05/MF A01. Order Number DE84000963.

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Requirements for the design and development of a photovoltaic cell-substrate bonding system are presented. In accordance with these requirements, various commercially available bonding materials were tested for thermal conductivity, thermal-cycling degradation, intrinsic bond thickness, degradation over life, and shear and tensile strengths. Advantages and disadvantages of each candidate material are listed. In many instances, material behavior differed significantly from manufacturer specifications. Finally, two designs each for point- and line-focus receivers were fabricated using different substrate materials (copper-clad invar vs alumina) and bonding methods (thermal grease/retaining clips vs RTV) and tested for material compatibility and stability, manufacturability, electrical and thermal performance, and potential for cost reduction. The copper-clad invar design appears to offer a slight cost advantage over the alumina/RTV system.

55600 **(SAND—83-7024) Design and development of a high-concentration and high-efficiency photovoltaic concentrator using a curved Fresnel lens.** Scharlack, R.S.; Moffat, A. (Thermo Electron Corp., Waltham, MA (USA)). Aug 1983. Contract AC04-76DP00789. 157p. NTIS, PC A08/MF A01. Order Number DE84000967.

Thermo Electron has designed a high concentration photovoltaic module that uses a domed, point-focus Fresnel lens. Their design, design optimization process, and results from lens and receiver tests are described in this report. A complete module has not been fabricated and probably will not be fabricated in the future; however, Thermo Electron's optical design, analysis, and testing of both secondary optical units and domed Fresnel lenses have made a significant contribution to our project. Tooling errors prevented the lens from reaching its potential efficiency by the end of the contract, and resolution of these tooling problems is currently being attempted with a follow-on contract, No. 68-9463.

55601 **Applications of hydrodynamic modulation at rotating disk electrodes to semiconductor electrochemistry.** Miller, B. (Bell Telephone Labs., Murray Hill, NJ); Bruckenstein, S. *Annals of the New York Academy of Sciences;* **404**: 473-474(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

If a chemical reaction proceeds exclusively at the photoelectrode, then its current-potential characteristic in the appropriate region depends solely on the surface concentrations of the redox-active species. This surface concentration dependence under controlled light flux has been employed diagnostically by taking advantage of the rigorously defined mass transport conditions of the rotating disk electrode (RDE), in particular, through the use of sinusoidal hydrodynamic modulation (SHM) at the RDE. In these experiments, incident light fluxes larger than the maximum mass flux of electroactive species to the semiconductor disk were used to test whether the response predicted would be met and thus indicate that a selective reaction was occurring. A formulation is found wherein the ratio of photobarrier and electrochemical impedances determines the modulation response. (LEW)

55602 **Energy relationships for selected cultural investments.** Blankenhorn, P.R.; Bowersox, T.W.; Weyers, R.E. (Pennsylvania State Univ., University Park). *Forest Science;* **28**: No. 3, 459-469(Sep 1982). Contract ET-78-G-01-3070.

An energy balance was used to establish the minimum recoverable biomass needed to justify cultural investment energies for using forest biomass as a source of energy. The balance accounted for (1) energy inputs needed for production (control fertilization, irrigation, and fertilization/irrigation), harvesting, processing, and transportation, and (2) conversion efficiencies for converting the biomass into usable heat, process steam, or electricity. Total energy inputs for each amendment included energy values for amendment manufacturing, amendment application, biomass harvesting, biomass processing, and biomass transportation. This total energy value coupled with conversion efficiency was used to establish the minimum ovendry kg of biomass per kg amendment (N, P, K, Ca, and water) needed to justify the cultural investment. Published results from biomass production studies were analyzed using procedures established in this article. This article established the need to analyze both conversion and cultural management strategy in completing a comprehensive energy balance.

55603 **Hole matrix vertical junction solar cell.** Holt, J.F. US Patent Application 6-356,574. 9 Mar 1982. 10p.

An improved vertical junction solar cell is provided which comprises a thin silicon chip having on one surface thereof a plurality of holes therein closely spaced in a desired array, the walls of the holes defining the vertical junction of the cell. The resulting structure provides improved light utilization during the entire life of the cell, and improved radiation resistance, as compared to grooved structure cells.

1406 Photovoltaic Power Systems

55604 **(DOE/ET/20347—T2) Solar experiment. Mississippi County Community College, Blytheville, Arkansas.** (Mississippi County Community Coll., Blytheville, AR (USA)). [nd]. Contract FG05-77ET20347. 12p. NTIS, PC A02/MF A01. Order Number DE83018251.

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The photovoltaic total energy system supplying both electrical and thermal energy to the Mississippi County Community College (MCCC) in Blytheville, Arkansas is given a brief, nontechnical overview. Also described is the energy-conscious design of the facility, which includes landscaping and a campus organized around a central concourse that is passively heated by a glazed barrel-vault roof. The total energy system consists of solar cells at the foci of parabolic trough collectors cooled by ethylene glycol solution. (LEW)

55605 **(N—8323295) The solar aircraft.** (National Aeronautics and Space Administration, Washington, DC (USA)). Mar 1983. 13p. (NASA-TM—77042). NTIS, PC A02/MF A01.

Transl. from Flug Rev. Intern. (West Germany); No. 3, 67-69 (Mar. 1982).

A discussion is given in a popular manner of the solar powered aircraft Solair I. The achievements of the designer are detailed, and trial runs leading up to the first successful flight are given. Technical data of Solair I are listed, and brief news items about it are presented.

55606 **(SAND—81-7081/1) Intermediate photovoltaic system application experiment operational performance report. Volume 1. Sky Harbor Airport Project, Phoenix, AZ, June-December 1982.** (Sandia National Labs., Albuquerque, NM (USA); Boeing Computer Services Co., Seattle, WA (USA)). Aug 1983. Contract AC04-76DP00789. 227p. NTIS, PC A11/MF A01. Order Number DE84000966.

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This report presents the data accumulated during June 1 through December 31, 1982 at the intermediate photovoltaic project at the Sky Harbor Airport, Phoenix, Arizona. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

55607 **(SAND—81-7082) Intermediate photovoltaic system application experiment operational performance report for the BDM Office Building Project for November 1982 through March 1983.** (Boeing Computer Services Co., Seattle, WA (USA)). Aug 1983. Contract AC04-76DP00789. 131p. NTIS, PC A07/MF A01. Order Number DE84000962.

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This report presents the data accumulated during November 1982 through March 1983 at the intermediate photovoltaic project at BDM Office Building, Albuquerque, NM. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

55608 **(SAND—81-7085/20) Intermediate photovoltaic system application experiment operational performance report. Volume 20. For Lovington Square Shopping Center, Lovington, New Mexico, February-March 1983.** (Sandia National Labs., Albuquerque, NM (USA); Boeing Computer Services Co., Seattle, WA (USA)). Aug 1983. Contract AC04-76DP00789. 50p. NTIS, PC A03/MF A01. Order Number DE84000971.

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This report presents the data accumulated during February and March 1983 at the intermediate photovoltaic project at Lovington Square Shopping Center, Lovington, New Mexico. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

55609 **(SAND—81-7086/20) Intermediate photovoltaic system application experiment operational performance report. Volume 20. For Newman Power Station, El Paso, Texas, February-March 1983.** (Sandia National Labs., Albuquerque, NM (USA); Boeing Computer Services Co., Seattle, WA (USA)). Aug 1983. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01. Order Number DE84000965.

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This report presents the data accumulated during February and March 1983 at the intermediate photovoltaic project at Newman Power Station, El Paso, Texas. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

55610 **(SAND—81-7087/10) Intermediate photovoltaic system application experiment operational performance report. Volume 10. For Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma, February-March 1983.** (Sandia National Labs., Albuquerque, NM (USA); Boeing Computer Services Co., Seattle, WA (USA)). Aug 1983. Contract AC04-76DP00789. 57p. NTIS, PC A04/MF A01. Order Number DE84000970.

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This report presents the data accumulated during February and March 1983 at the intermediate photovoltaic project at Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

1407 Solar Thermal Power Systems

55611 **(Juel—1847) Investigations of thermochemical energy storage with sulfuric oxides.** Abu Leiyeh, O. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). May 1983. 156p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83751349.

Thesis.

In this study a system using the catalytical decomposition/recombination of sulphuric oxides has been investigated for electricity production in small plants. The decomposition reaction of SO_3 is used to gather the solar energy concentrated by a field of parabolic dishes. The exothermal recombination of SO_2 and O_2 provides the energy, which can be used to generate steam required for electricity production. Two concepts have been studied and optimized. The first one using a gas turbine showed a small efficiency because of the high amount of energy needed for compressing the gases. Additionally, gas turbines which can withstand the corrosive effect of these mediums are not available. The second concept using a steam turbine was therefore optimized for different system parameters and showed an efficiency of about 35% for the whole energy storage system and electricity production. The energy stored during 8 hours of daylight operation is sufficient to meet electricity production demands around the clock. An economical evaluation of the system showed that the system, even with various simplifications as assumed here, is still not competitive with other electricity producing systems such as Diesel generators which are presently being used in isolated rural areas.

55612 **(N—8323705) Proceedings: Fourth Parabolic Dish Solar Thermal Power Program Review.** (Jet Propulsion Lab., Pasadena, CA (USA)). Feb 1983. 340p. (NASA-CR—170297; DOE/JPL—1060/58). NTIS, PC A15/MF A01.

The results of activities within the parabolic dish technology and applications development program are presented. Stirling, organic Rankine and Brayton module technologies, associated hardware and test results to date, concentrator development and progress, economic analyses, and international dish development activities are covered. Two panel discussions, concerning industry issues affecting solar thermal dish development and dish technology from a utility/user perspective, are also included.

1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

REFER ALSO TO CITATION(S) 56307

55613 **(DOE/ET/21002—T27) OTEC support services. Quarterly technical progress report No. 21, 15 May-15 August 1983.** (VSE Corp., Alexandria, VA (USA)). Sep 1983. Contract AC02-78ET21002. 8p. NTIS, PC A02/MF A01. Order Number DE84000532.

Progress is reported on the system integration, system engineering, and management services for the OTEC program under the following tasks: (1) survey, analysis, and evaluation; (2) program technical monitoring; (3) development and implementation of methodology; (4) technical assessments; (5) OTEC systems integration; (6) environment and siting considerations; and (7) transmission subsystem considerations.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 55585, 55604

55614 **(DOE/CS/32378—T1-Vol.1) Maryland National Capital Park and Planning Commission Shady Grove Solar Office Building. Volume I. Final technical report.** (Maryland National Capital Park and Planning Commission, Silver Spring (USA)). Oct 1982. Contract AC03-76CS32378. 92p. NTIS MF A01. Order Number DE84000160.

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The Shady Grove Solar Office Building, located in Gaithersburg, Maryland is a 3400 ft² structure incorporating both active and passive solar heat collection and storage. Solar energy is collected by 1500 ft² of KTA tubular collectors, stored in a 3000 gallon steel tank, and distributed throughout the building by three water-to-air heat exchangers in three air handlers. Volume 1 of this report includes a narrative description of the building and solar energy system; specifications for the solar equipment; acceptance test plan No. 1; acceptance test plan no. 2; and photos of completed project.

55615 **(DOE/CS/32378—T1-Vol.2) Maryland National Capital Park and Planning Commission Shady Grove Solar Office Building. Volume II. Final technical report.** (Maryland National Capital Park and Planning Commission, Silver Spring (USA)). Oct 1982. Contract AC03-76CS32378. 127p. NTIS MF A01. Order Number DE84000058.

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The active solar heating system of the 3000 ft² Shady Grove Solar Office Building includes 1500 ft² of KTA tubular collectors, a 3000 gallon steel storage tank, and three water-to-air heat exchangers in three air handlers. Volume two is intended to be used by on-site technical and maintenance personnel for the routine operation of the solar heating system. It includes submittals by the contractors, specifications, drawings, and other material useful for operating and maintaining the system. This volume is organized in sections with general operating procedures followed by a section for each important subsystem or component.

55616 **(DOE/R5/10223—4-Rev.1) Midwest Appropriate Technology Small Grants Program. Final progress report Revision 1, March 5-September 21, 1983.** Hert, A. (Indiana Laborers' Training Trust Fund, Bedford (USA)). 21 Sep 1983. Contract FG02-80R510223. 8p. NTIS, PC A02/MF A01. Order Number DE84000856.

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A brief report is given on the performance of a solar heating system for a maintenance building of the Indiana Laborers Training Institute.

55617 **(DOE/SF/11593—T1) Tailoring polymer films for solar-collector use. Final report, Phase I.** Fouser, J.P. (Anradex Ltd., San Francisco, CA (USA)). Sep 1983. Contract AC03-82SF11593. 8p. NTIS, PC A02/MF A01. Order Number DE83018117.

The purpose of Phase I was to make and evaluate several types of Polyacrylonitrile (PAN) polymers in film form that could meet the performance criteria with respect to thermal, ultraviolet, and tensile strength stability for use as exterior glazing in a low-cost solar collector or for the internal heat exchange component. Tests were conducted of seven film specimens and the results are discussed. It is concluded that acrylonitrile homopolymer films when properly cast ad processed have good mechanical properties, have long uv stability, and are usable for prolonged periods at 300 F.

55618 **(NP—3770380) Solar energy guide for Valais.** Clivaz, M.; Maurer, M.; Gapany, R. (Arbeitsgruppe fuer Sonnenenergie, Sitten (Switzerland)). 2 May 1982. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83770380.

The sun always played an important role on the social and cultural sector in the Swiss Canton of Valais. Architecture, vineyards, tradition and customs are a proof of this. This background explains the general positive attitude for a wider application of solar energy in Valais. The authorities try not to offend the traditional architectural style. Solar collectors on roofs have therefore again and again been rejected. Aesthetics are a matter of individual taste and may change quickly, better information on solar energy may contribute to bring about changes. The difficulties encountered by engineers, architects and local authorities were the actual reason for publishing this guide on solar energy.

55619 **(PB—83-227892) Analysis of district solar ponds with heat pump.** Lund, P.D.; Routti, J.T. (Helsinki Univ. of Technology, Espoo (Finland). Dept. of Technical Physics). 7 Jan 1983. 23p. (TKK-F-A—497). NTIS, PC E03/MF E01.

Performance of solar ponds in cold climates can be significantly improved with heat pumps and district heating. The authors present a detailed computer performance study of a 1260 m2 pond with a heat pump used for the heating of a 25-house community. They also discuss briefly the costs and load profiles of these systems. The study indicates that the solar pond may be regarded as a potential heat source and seasonal storage at high northern latitudes.

55620 **(SERI/STR—254-1515) Flat-plate solar-collector performance data base and user's manual.** Kirkpatrick, D.L. (Sun Designs, Glen Moore, PA (USA)). Jul 1983. Contract AC02-77CH00178. 221p. NTIS, PC A10/MF A01. Order Number DE83011993.

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This manual provides the reader with a thorough understanding on the type of collector thermal performance information which is required in active system design and analysis. It also contains thermal performance test data on 109 commercially available solar collectors which were evaluated in a single, uniform test program, the Interim Solar Collector Test (ISCT) Program. In addition to recounting the ISCT program and its results the manual contains an introduction on the engineering and physics of a flat-plate solar collector operation. A step-by-step analysis of heat gains and losses is provided to help the reader understand both the source and applicability of the parameters used to describe collector thermal performance. A brief description of the engineering basis for the ASHRAE Standard 93-77 test procedure and the method are included. To demonstrate the sensitivity to variations of collector performance parameters of the annual output of representative solar heating systems, three sets of F-Chart (4.0) system performance predictions are given. Finally, a sensitivity analysis study is presented which considers the heat loss and optical gain parameters of flat-plate collectors, in terms of how they affect the overall solar heating system solar fraction.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 55600, 55612, 55618

55621 **(DOE/SF/10816—T1) Residential cooling by nocturnal radiation.** Thompson, T.L. (Arizona Univ., Tucson (USA). Environmental Research Lab.). May 1983. Contract AC03-80SF10816. 82p. NTIS, PC A05/MF A01. Order Number DE83013419.

Data were collected from an adobe building in Tucson with a metal roof to evaluate residential cooling by nocturnal radiation. Experimental results were correlated by an equation similar to that used to describe solar collector performance, relating the heat rejection rate (-q/sub u/), to the net radiation term (R), the inlet fluid (t/sub fl/) and ambient air temperature (t/sub a/), using a plate efficiency factor (F/sub R/) and heat loss coefficient (U/sub L/). Cooling by nocturnal radiation alone was found to be inadequate during peak summer cooling periods. The results were extrapolated to the case of evaporative cooling using a wetted roof; heat rejection from the wet roof appears adequate for residental cooling in a hot, arid climate.

55622 **(LA—9842-MS) Chemical conversion surfaces for solar-energy applications.** Moore, S.W.; Clements, J.S.; Doty, W.R. (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 58p. NTIS, PC A04/MF A01. Order Number DE84000107.

One of the major impediments to the utilization of solar energy is the initial cost of the systems. One mechanism for reducing this initial cost is reduction of component costs. Present-day selective coatings are relatively expensive, costing \$10 to \$20/m² (\$1 to \$2 per ft²). Chemical conversion coating of substrate materials is a means by which selective coatings might be produced for low-

temperature active and passive applications at a low cost. Some researchers have predicted chemical costs of only a few cents per ft^2. Much information is needed for both optical property optimization and durability to see if any of these coatings might hold promise for solar applications. This study is an attempt to determine which coatings and substrate combinations might hold the greatest promise. The following substrate materials are investigated: aluminum, copper, brass, zinc, cadmium, aluminum/zinc alloys, nickel, iron, and stainless steel.

55623 **(LMSC-D—876763) Evaluation of selective solar-absorber surfaces, Phase II. Final technical report, October 1, 1980-June 30, 1982.** Osiecki, R.A. (Lockheed Palo Alto Research Labs., CA (USA)). Sep 1982. Contract AC04-78CS15361. 92p. NTIS, PC A05/MF A01. Order Number DE84000067.

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Samples of black chrome (4), copper oxide (1), nickel oxide (1), chromate conversion coating (1), and a thickness sensitive paint (1) were exposed to 90°C/95% relative humidity (RH), 90°C/low RH for up to 5000h. The optical, chemical and surface morphological characteristics of the samples were monitored at various times during the exposures. The copper oxide surface finish was the least environmentally stable finish. During exposure to the 90°C/95% RH environment, the spectral reflectance of the finish progressively increased below the near infrared and decreased at longer wavelengths, the copper oxidized from the 0 and +1 valence states to +2, and the surface finish became more porous. Similar but smaller changes were noted in the samples exposed to the natural environment in a collector box for 9.5 months. The properties of the samples exposed to 90°C/low RH did not significantly change. The black chrome surface finish changed slightly during the first 1250h of exposure to the 90°C/low RH environment. The spectral reflectance increased slightly at wavelengths greater than about 1.0 microns, the chromium was either oxidized from the 0 valence state or reduced from the +6 valence state to a +3 valence state and the surface morphology became more grainy during environmental exposure. Similar changes were observed to the samples exposed to the natural environment. The sample exposed to the 90°C/95% RH environment did not show the change in spectral reflectance or the chromium reduction reaction. The properties of the nickel oxide, chromate conversion and thickness sensitive paint surface finish did not change significantly during environmental exposure.

1420 Heat Storage

REFER ALSO TO CITATION(S) 55611, 55812

55624 **(SERI/TP—252-2055) Advanced high-temperature molten-salt storage research.** Copeland, R.J.; Coyle, R.T. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1983. Contract AC02-77CH00178. 8p. (CONF-830974—8). NTIS, PC A02/MF A01. Order Number DE84000001.

From Physical and chemical energy storage annual contractors' review meeting; Arlington, VA, USA (12 Sep 1983).

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We are researching advanced high-temperature molten-salt thermal storage for use in direct absorption receiver and thermal storage (DARTS) solar thermal systems. A molten salt at 900°C or higher is both the receiver heat transfer medium and the storage medium; a unique insulated platform (raft) separates the hot and cold medium in the thermocline thermal storage. We have measured raft performance experimentally, and it performs equally or better than a natural thermocline. Containment materials for the molten salts ae being experimentally screened. NaOH has a very high corrosion rate on ceramics and metals. Both carbonates and chlorides can be contained at 900°C with relatively little corrosion. Based on the measured corrosion rates, the economic potential of molten-salt thermal storage was analyzed. Both the chlorides and carbonates have potential (i.e., cost less than value) at the capacity of storage expected for commercial-scale solar thermal systems.

15 GEOTHERMAL ENERGY

55625 **(CONF-8208109—Vol.1) Fourth symposium on the Cerro Prieto geothermal field, Baja California, Mexico. Actas proceedings. Volume I.** (Comision Federal de Electricidad, Mexico City; Department of Energy, Washington, DC (USA). Div. of Geothermal Energy). 1982. Contract W-7405-ENG-48. 339p. (In English and Spanish). NTIS, PC A15/MF A01. Order Number DE83013533.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

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Twenty-one papers are included. Separate abstracts were prepared for five. Fifteen papers in Spanish and one summary are listed by title. (MHR)

55626 (SGP-TR—60, pp 1-3) **DOE geothermal research and development program.** Toms, R.S.H. (Department of Energy, Washington, DC). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The progress of geothermal development since the Geothermal Steam Act of 1970 is reviewed and the present status of geothermal technology and the recent accomplishments of the DOE geothermal program are discussed. Then the present DOE budget picture and program planned by DOE are discussed, giving a context for reservoir engineering research and development.

1501 Resource Status And Assessment

55627 (SGP-TR—60, pp 31-37) **Engineering and geological analyses of the geothermal energy potential of selected sites in the state of Alaska.** Economides, M.J.; Ansari, J.; Arce, G.N.; Reeder, J.W. (Univ. of Alaska, Fairbanks). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

It is the purpose of this report to produce ideas and/or options on how geothermal resources might be actually developed assuming a given geological data base for several geothermal prospect areas in Alaska. The economic attractiveness or lack thereof is demonstrated using a common means of comparison among the options. Six geothermal prospect sites have been selected for this study: Tenakee Springs, Sitka Region (Goddard Hot Springs), Pilgrim Springs, the Klawasi Region of Copper Valley, Summer Bay on Unalaska, and the Makushin Volcanic Region of Unalaska.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 55661, 55668, 55699, 55704, 55708, 55709, 55712, 55713, 55715

55628 (CONF-8208109—Vol.1, pp 35-41) **Analysis of the Nuevo Leon magnetic anomaly and its possible relation to the Cerro Prieto magmatic-hydrothermal system.** Goldstein, N.E.; Wilt, M.J.; Corrigan, D.J. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A15/MF A01. Contract AC03-76SF00098.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

The broad dipolar magnetic anomaly whose positive peak is centered near Ejido Nuevo Leon, some 5 km east of the Cerro Prieto I Power Plant, has long been suspected to have a genetic relationship to the thermal source of the Cerro Prieto geothermal system. This suspicion was reinforced after several deep geothermal wells, drilled to depths of 3 to 3.5 km over the anomaly, intersected an apparent dike-sill complex consisting mainly of diabase but with minor rhyodacite. A detailed fit of the observed magnetic field to a computer model indicates that the source may be approximated by a tabular block 4 by 6 km in area, 3.7 km in depth, 2.3 km thick, and dipping slightly to the north. The geological model derived from the magnetic study is generally supported by other geophysi-

cal data. In particular earthquake data suggest dike injection is occurring at depths of 6 to 11 km in an area beneath the magnetic source. Thus, it is possible that heat for the geothermal field is being maintained by continuing crustal extension and magmatic activity.

55629 (CONF-8208109—Vol.1, pp 123-132) **Old field at Cerro Prieto considered as a leaky aquifer.** Grant, M.A. (Department of Scientific and Industrial Research, Wellington, New Zealand); O'Sullivan, M.J. 1982. NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

Chemical and thermal changes are used to estimate the relative contributions of recharge from lateral flow and from shallower aquifers to the old field of Cerro Prieto. Pressure changes are then used to estimate the permeability of the hypothesized sealing layer overlying the reservoir. It is found that this layer is considerably less permeable than the producing aquifers; but not sufficiently impermeable to exclude flow into the reservoir of the cooler waters above. The producing aquifer is best considered as leaky rather than confined.

55630 (CONF-8208109—Vol.1, pp 145-151) **Vapor fluency to the well feeding zone of Cerro Prieto I.** Nieva, D.; Fausto, J.; Gonzalez, J.; Garibaldi, F. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55631 (CONF-8208109—Vol.1, pp 153-160) **Relationship of radon concentration to spacial and temporal variations of reservoir thermodynamic conditions in the Cerro Prieto geothermal field.** Semprini, L.; Kruger, P. (Stanford Univ., CA). 1982. NTIS, PC A15/MF A01. Contract AT03-80SF11459.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

Measurements of radon concentration in produced fluids at Cerro Prieto are evaluated with respect to spatial and temporal variations in reservoir thermodynamic conditions and the rock mass to fluid mass ratio for radon emanation. Observed higher concentration of radon at wells with higher fluid enthalpy can be attributed to the higher steam fraction in the wellhead fluid. Correlations of radon concentration to specific volume of pore fluid leads to improved correlation coefficients. The improvement results from the dependence of specific volume on both enthalpy and reservoir temperature. Temporal variations in radon concentration reflect changing phase conditions in the reservoir. Observations over a 2-year interval show significant changes in the producing zones. For example, the constant, low concentration along the western edge of the field indicates a fluid of low steam saturation. In the eastern area, radon concentrations have increased significantly suggesting an increase in the steam saturation in this part of the reservoir due to exploitation. Other areas, e.g., the southeast area, show decreased radon concentration, indicating a decrease in the vapor content of the field. Concurrent measurements of ammonia, a soluble component of the noncondensable gases, support the observations of partitioning of gas components, with wellhead concentration dependent on spacial variations in steam saturation over the field.

55632 (CONF-8208109—Vol.1, pp 187-201) **Inference about the structure based on two aftershocks in the Mexicali-Imperial Valley.** Wong, V.; Frez, J. (Centro de Investigacion Cientificia y de Educacion Superior de Ensenada, Mexico). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55633 (CONF-8208109—Vol.1, pp 265-284) **Model for the heat source of the Cerro Prieto magma-hydrothermal system, Baja California, Mexico.** Elders, W.A. (Univ. of California, Riverside); Bird, D.K.; Williams, A.E.; Schiffman, P. 1982. NTIS, PC A15/MF A01. Contract FC07-80ID12145;AT03-80SF11458.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

Earlier studies at Cerro Prieto have led to the development of a qualitative model for fluid flow in the geothermal system before it was drilled and perturbed by production. Current efforts are directed towards numerical modelling of heat and mass transfer in the system in this undisturbed state. The two-dimensional model assumes that the heat source was a single basalt/gabbro intrusion which provided heat to the system as it cooled. After compiling various information on the physical properties of the reservoir, calculated the enthalpy contained in two 1 cm thick sections across the reservoir orthogonal to each other was calculated. Next various shapes, sizes and depths were considered for the intrusion as initial conditions and boundary conditions for the calculations of heat transfer. A family of numerical models which so far gives the best matches to the conditions observed in the field today have in common a funnel-shaped intrusion with a top 4 km wide emplaced at a depth of 5 km some 30,000 to 50,000 years ago. The qualitative model postulated the existence of an inclined plume of hot geothermal water rising from the northeast with an inclination of 45°. This inclination, if due to the effect of regional groundwater, requires very high horizontal permeability. It is believed, therefore, the component of horizontal flow is due largely to locally low permeability in the shallow surface rocks.

55634 (DOE/ET/27111—10) **Consolidation of geologic studies of geopressured geothermal resources in Texas. 1982 annual report.** Morton, R.A.; Ewing, T.E.; Kaiser, W.R.; Finley, R.J. (Texas Univ., Austin (USA). Bureau of Economic Geology). Mar 1983. Contract AC08-79ET27111. 205p. NTIS, PC A10/MF A01. Order Number DE84000481.

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Detailed structural mapping at several horizons in selected study areas within the Frio growth-fault trend demonstrates a pronounced variability in structural style. At Sarita in South Texas, shale mobilization produced one or more shale ridges, one of which localized a low-angle growth fault trapping a wedge of deltaic sediments. At Corpus Christi, shale mobilization produced a series of large growth faults, shale-cored domed anticlines, and shale-withdrawal basins, which become progressively younger basinward. At Blessing, major growth faults trapped sands of the Greta/Carancahua barrier system with little progradation. At Pleasant Bayou, a major early growth-fault pattern was overprinted by later salt tectonics - the intrusion of Danbury Dome and the development of a salt-withdrawal basin. At Port Arthur, low-displacement, long-lived faults formed on a sand-poor shelf margin contemporaneously with broad salt uplifts and basins. Variability in styles is related to the nature and extent of Frio sedimentation and shelf-margin progradation and to the presence or absence of salt. Structural styles that are conducive to the development of large geothermal reservoirs include blocks between widely spaced growth faults having dip reversal, salt-withdrawal basins, and shale-withdrawal basins. These styles are widespread on the Texas Gulf Coast. However, actually finding a large reservoir depends on demonstrating the existence of sufficient sandstone with adequate quality to support geopressured geothermal energy production.

55635 (SGP-TR—60, pp 5-17) **Geothermal reservoirs in hydrothermal convection systems.** Sorey, M.L. (Geological Survey, Menlo Park, CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Geothermal reservoirs commonly exist in hydrothermal convection systems involving fluid circulation downward in areas of recharge and upwards in areas of discharge. Because such reservoirs are not isolated from their surroundings, the nature of thermal and hydrologic connections with the rest of the system may have significant effects on the natural state of the reservoir and on its response to development. Conditions observed at numerous developed and undeveloped geothermal fields are discussed with respect to a basic model of the discharge portion of an active hydrothermal convection system. Effects of reservoir development on surficial discharge of thermal fluid are also delineated.

55636 (SGP-TR—60, pp 19-24) **Geologic and preliminary reservoir data on the Los Humeros Geothermal System, Puebla, Mexico.** Ferriz, H. (Stanford Univ., CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Exploratory drilling has confirmed the existence of a geothermal system in the Los Humeros volcanic center, located 180 km east of Mexico City. Volcanic activity in the area began with the eruption of andesites, followed by two major caldera-forming pyroclastic eruptions. The younger Los Potreros caldera is nested inside the older Los Humeros caldera. At later stages, basaltic andesite, dacite, and olivine basalt lavas erupted along the ring-fracture zones of both calderas. Geologic interpretation of structural, geophysical, and drilling data suggests that: (1) the water-dominated geothermal reservoir is hosted by the earliest andesitic volcanic pile, is bounded by the ring-fracture zone of the Los Potreros caldera, and is capped by the products of the oldest caldera-forming eruption; (2) permeability within the andesitic pile is provided by faults and fractures related to intracaldera uplift; (3) the geothermal system has potential for a large influx of meteoric water through portions of the ring-fracture zones of both calderas; and (4) volcanic centers with similar magmatic and structural conditions can be found in the eastern Cascades, USA.

55637 (SGP-TR—60, pp 39-43) **Hydrothermal alteration and tectonic setting of intrusive rocks from East Brawley, Imperial Valley: an application of petrology to geothermal reservoir analysis.** Keskinen, M.; Sternfeld, J. (Occidental Research Corp., Irvine, CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A geothermal well near East Brawley intersected a series of thin (3 to 35m) diabasic to dioritic intrusives. The petrology and chemistry of these meta-igneous rocks can provide insight into the thermal and fluid chemical characteristics of the reservoir and into the processes of magma generation at depth. A description of the rock types and their hydrothermal alteration is presented in order to increase the petrologic data base relating to this important facet of the geothermal potential of the Salton Trough and to provide a case study illustrating how detailed petrologic examination of well cuttings can provide important input in the construction of a geothermal reservoir model.

55638 (SGP-TR—60, pp 171-176) **Movement of geothermal fluid in the Cerro Prieto field as determined from well log and reservoir engineering data.** Halfman, S.E.; Lippmann, M.J.; Zelwer, R. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AC03-76SF00098.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A hydrogeologic model of the Cerro Prieto geothermal field in its undisturbed state, developed on the basis of well log and reservoir engineering data, is discussed. According to this model, geothermal fluid enters the field from the east through a deep (>10,000 ft) sandstone aquifer which is overlain by a thick shale unit which locally prevents the upward migration of the fluid. As it flows westward, the fluid gradually rises through faults and sandy gaps in the shale unit. Eventually, some of the fluid leaks to the surface in the western part of the field, while the rest mixes with surrounding colder waters.

55639 (SGP-TR—60, pp 219-224) **Proximity functions for modeling fluid and heat flow in reservoirs with stochastic fracture distributions.** Pruess, K.; Karasaki, K. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AC03-76SF00098.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

After a brief review of the multiple interacting continua method, the concept of a proximity function is introduced as the central geometrical quantity which defines the matrix-fracture interaction. Subsequently, proximity functions are considered for regular and irregular fracture distributions, using Monte Carlo integration techniques. (MHR)

55640 (SGP-TR—60, pp 225-230) **Quasi-three-dimensional model applied to geothermal reservoir system with heat flow from deeper zones.** Hirakawa, S.; Ichikawa, M. (Univ. of Tokyo, Japan). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

It is important to grasp the reservoir fluid behavior under operations in the geothermal reservoir development. The calculation procedure of quasi-three-dimensional model is clarified and a flow chart of the model is presented. As example calculations, the developed simulator is applied to simplified geothermal reservoirs which contain heat flow from the deeper zones.

55641 (SGP-TR—60, pp 231-236) **Reservoir simulation studies on the Cerro Prieto geothermal field.** Castaneda, M. (Instituto de Investigaciones Electricas, Cuernavaca, Mexico); Abril, A.; Arellano, V.; Marquez, R. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A reservoir engineering and simulation study is being carried out on the Cerro Prieto geothermal field. A preliminary material balance has been applied to the old part of this field. A single block with constant properties in the horizontal direction was used for this preliminary material balance. The vertical block column was subdivided in several levels in order to take into account the known lithologic column. From existing pressure and enthalpy field histories, a single phase (liquid) reservoir assumption was selected. Under this assumption, a lateral radial recharge was considered in obtaining the pressure and enthalpy history match. These preliminary results indicate that another type of recharge is probably taking place in this part of the field, rather than lateral radial.

55642 (SGP-TR—60, pp 261-268) **Analysis of Sweet Lake geopressured-geothermal aquifer.** Andrade, M.; Rago, F.; Ohkuma, H.; Sepehrnoori, K.; Peters, E.; Dorfman, M. (Univ. of Texas, Austin). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AC08-79ET27112.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The Sweet Lake geopressured-geothermal aquifer, located southeast of Lake Charles, Louisiana, is modeled by a two-dimensional geopressured-geothermal simulator. This aquifer is a sandstone within the Frio formation at depths between 15,000 to 15,640 ft with a net porous thickness of 250 ft, a calculated in-situ permeability (from drawdown data) of 17 md, an estimated porosity of 24%, a uniaxial compaction coefficient of 4.5×10^{-7} psi^{-1} and a solution gas-water ratio of 11 SCF/STB all at the initial reservoir pressure of 12,060 psi. These parameters are typically pressure sensitive in geopressured-geothermal aquifers and are critically important to aquifer performance. Several simulation experiments are conducted which investigate the effects of varying initial values for these parameters with the experimentally determined values as means. The simulations give both optimistic and pessimistic expectations for aquifer performance. The expected life of the geopressured-geothermal well is reported for each simulation.

55643 (USGS-OFR—79-62) **Thermal ground-water discharge and associated convective heat flux, Bruneau-Grand View area, southwest Idaho.** Young, H.W.; Lewis, R.E.; Backsen, R.L. (Geological Survey, Boise, ID (USA). Water Resources Div.). May 1979. 33p. US Geological Survey - Open File Services, Box 25425, Denver Federal Center, Denver, CO 80225.

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The Bruneau-Grand View area occupies about 1100 square miles in southwest Idaho. The area has a rural population dependent on ground-water irrigation. Temperature of the ground water ranges from 15°C to more than 80°C. Ground water for irrigation is obtained from flowing and pumped wells. Discharge of thermal ground water from 104 irrigation wells and 5 hot springs in 1978 was about 50,500 acre-feet. Convective heat flux from the geothermal system associated with this discharge was 4.97×10^7 calories per second.

55644 **Preliminary studies of the reservoir capacity and the generating potential of the Baca geothermal field, New Mexico.** Bodvarsson, G.S.; Vonder Haar, S.; Wilt, M.; Tsang, C.F. (Lawrence Berkeley Lab., California). *Water Resources Research;* 18: No. 6, 1713-1723(Dec 1982). Contract AC03-76SF00098.

A 50-MW/sub e/ geothermal power plant is being considered for the Baca site in the Valles Caldera, New Mexico, as a joint venture of the Department of Energy (DOE) and Union Oil Company of California. To date, over 20 wells have been drilled on the prospect, and the data from these wells indicate the presence of a high-temperature, liquid-dominated reservoir. In this paper, data from the open literature on the physical characteristics of the field are used to estimate the amount of hot water in place (reservoir capacity) and the length of time the reservoir can supply steam for a 50-MW/sub e/ power plant (reservoir longevity). The reservoir capacity is estimated to be 10^{12} kg of hot fluid by volumetric calculations using existing geological, geophysical, and well data. The criteria used are described and the sensitivity of the results discussed. The longevity of the field is studied using a two-phase numerical simulator (SHAFT79). A number of cases are simulated based upon different boundary condition and upon injection and production criteria. The results obtained from the simulation studies indicate that it is questionable that the Baca field can supply enough steam for a 50-MW/sub e/ power plant for 30 years. Although the estimated reservoir reserves greatly exceed those needed for a 50-MW/sub e/ power plant, the low transmissivity of the reservoir would cause localized boiling and rapid pressure decline during exploitation. It is therefore apparent that the conventional zero-dimensional (lumped parameter models) cannot be used to evaluate the generation capacities of low-permeability fields such as the Baca field.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 55640, 55678, 55699

55645 (CONF-8208109—Vol.1, pp 3-34) **Cerro Prieto geothermal. Geophysical studies.** Fonseca, H.L. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55646 (CONF-8208109—Vol.1, pp 43-52) **Hypothesis to define the geothermal areas in the Mexicali Valley.** Prian C, R. (Comision Federal de Electricidad, Mexico City). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55647 (CONF-8208109—Vol.1, pp 53-59) **Survey on the remote sensors usefulness on the geothermal resources prospection at the Cerro Prieto, B.C., area.** Lopez, A.; Hernandez, R.; Garcia, G. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55648 (CONF-8208109—Vol.1, pp 81-91) **Study up-date of temperature behavior and distribution in Cerro Prieto I.** Navarro, F.X.; Bermejo, F.J.; Castillo, F.; Rivera, R. (Comision Federal de Electricidad, Mexico City). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55649 (CONF-8208109—Vol.1, pp 93-112) **Study up-date of temperature behavior and distribution in Cerro Prieto II and III.** Rivera, R.; Bermejo, F.J.; Castillo, F.; Perez, H.; Abrajan, A. (Comision Federal de Electricidad, Mexico City). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55650 (CONF-8208109—Vol.1, pp 163-185) **Attenuation and origin of the coda waves in the Cerro Prieto geothermal field.** Reyes, A.; Chang, A.; Albores, A. (Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Mexico). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55651 (CONF-8208109—Vol.1, pp 203-213) **Passive seismic surveys in Los Azufres geothermal field, Michoacan.** Mendoza, L. (Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Mexico); Reyes, A.; Razo, A.; Reyes, R. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55652 (CONF-8208109—Vol.1, pp 217-232) **Geothermal drilling at Cerro Prieto.** Dominguez, B. (Comision Federal de Electricidad, Mexico City). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55653 (LA-UR—83-2364) **Thermal design for protection of downhole electronic packages.** Bennett, G.A.; Sherman, G.R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831111—7). NTIS, PC A02/MF A01. Order Number DE83017322.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

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Design improvements made for downhole tools based on results obtained from the thermal analysis of the instrument package are described. Results include heat flux at the tool surface and temperature-time histories of each subsystem. The research stems from a need for tools that can survive the harsh environment present in geothermal wellbores. The high temperatures and pressures create stress on the tools that function in this environment. Improvements in the design of downhole tools lead to more accurate data obtained from the wellbore during experimentation. The analysis showed that the thermal potential and the conductance between electronics and its heat sink was too small and was misdirected. Significant improvements were achieved by increasing the available thermal capacity of the heat sink, the thermal potential between the heat sink and electronics, and the conductance of the heat transfer paths.

55654 (SGP-TR—60, pp 25-30) **Fieldwide reservoir engineering analysis of the Pilgrim Springs, Alaska, geothermal reservoir.** Economides, M.J. (Univ. of Alaska, Fairbanks); Economides, C.A.E.; Kunze, J.F.; Lofgren, B. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The wells drilled in the region of the geothermal anomaly near Pilgrim Springs provide considerable insight into the general characteristics of the geothermal system. Previous work, including resistivity studies and geothermometry are corroborated by the temperature profiles observed in the six wells. The existence of a hot water zone of about 150°C and at a depth of around 5000 ft is now virtually certain.

55655 (SGP-TR—60, pp 45-48) **Chemical and isotopic studies of the Coso geothermal area.** Fournier, R.O.; Thompson, J.M. (Geological Survey, Menlo Park, CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AC03-76SF00098.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Wellhead and downhole water samples were collected and analyzed from a 114.3-m well at Coso Hot Springs (Coso No. 1) and a 1477-m well (CGEH No. 1) 3.2 km to the west. The same chloride concentration is present in hot waters entering both wells (about 2350 mg/kg), indicating that a hot-water-dominated geothermal system is present. The maximum measured temperatures are

142°C in the Coso No. 1 well and 195°C in the CGEH No. 1 well. Cation and sulfate isotope geothermometers indicate that the reservoir feeding water to the Coso Hot Spring well has a temperature of about 240 to 250°C, and the reservoir feeding the CGEH well has a temperature of about 205°C. The variation in the chemical composition of water from the two wells suggests a model in which water-rock chemical equilibrium is maintained as a convecting solution cools from about 245 to 205°C by conductive heat loss. A total of 39 water samples collected from the Coso geothermal area and vicinity and were analyzed for major chemical constituents, δ D and $\delta^{18}O$. Nonthermal ground waters from the Coso Range were found to be isotopically heavier than those from the Sierra Nevada to the west. The similarity of the δ D value for the deep thermal water at Coso to that of the Sierra water suggests that the major recharge for the hydrothermal system comes from the Sierra Nevada rather than from local precipitation on the Coso Range.

55656 (SGP-TR—60, pp 189-195) **Resistivity logging of fractured basalt.** Stefansson, V.; Axelsson, G.; Sigurdsson, O. (Orkustofnun, Reykjavik, Iceland). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A lumped double porosity model was studied in order to estimate the effect of fractures on resistivity - porosity relations. It is found that the relationship between resistivity and porosity for fractured rock is in general not simple and depends both on the amounts of matrix porosity as well as the fracture orientation. However, when fractures dominate over matrix porosity the exponent <m> is close to 1.0. Resistivity-porosity relations have been determined for large amounts of basaltic formations in Iceland. An exponent close to 1.0 is found in all cases investigated. This is interpreted as fractures constitute a considerable part of the porosity of the basalts. In the IRDP-hole in Eastern Iceland it is found that the ratio of fracture porosity to total porosity decreases with depth.

55657 (SGP-TR—60, pp 289-294) **Retention of chemical tracers in geothermal reservoirs.** Horne, R.N.; Breitenbach, K.A.; Fossum, M.P. (Stanford Univ., CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AT03-80SF11459.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The advantages and disadvantages of chemical tracers for use in geothermal reservoir monitoring are examined. Tracers are used to determine the magnitude of connectivity between injection and production wells in order to estimate the likelihood of premature fluid breakthrough. Even though chemical tracers are generally less environmentally sensitive than radioactive materials, quantities injected need to be much larger to be distinguishable by chemical analysis. As a result, a non-equilibrium concentration of tracer material is injected into the reservoir, and the tracer is susceptible to retention within the reservoir by ion exchange, diffusion into the solids or immobile reservoir fluid, adsorption or dissolution. These various reactions lead to changes in the tracer concentration as the traced fluid flows through the reservoir, and therefore reduce the capability of the experiment to distinguish concentration changes due to purely mechanical effects. Experimental observations reported here show that substantial fractions of KI tracer were retained under reservoir conditions, even though it appears that the retained material was subsequently released into more dilute fluid. The result is an apparent storage and release mechanism that will distort the later response of a tracer breakthrough.

55658 (SGP-TR—60, pp 295-307) **Fluid geochemistry applications in reservoir engineering (vapour-dominated systems).** D'Amore, F.; Celati, R.; Calore, C. (Istituto Internazionale per le Ricerche Geotermiche, Pisa, Italy). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Fluid geochemistry has proved to be a valid tool for analyzing the processes occurring in geothermal reservoirs. The major effort is now invested in developing conceptual and quantitative models for chemical and physical processes that could produce the observed variations in fluid composition. These models are an effective complement to the classical methods of reservoir engineering in field development and exploitation. The fields in which the geochemical methods seem to be most effective are listed. Previous work in the field, as well as current development of research conducted on gas composition, is discussed and reviewed.

55659 (SGP-TR—60, pp 309-313) **Summary of the chemical characteristics of the HGP-A well; Puna, Hawaii.** Thomas, D.M. (Hawaii Inst. of Geophysics, Honolulu). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The HGP-A geothermal well is located on the Lower East Rift Zone of Kilauea Volcano. It was completed in 1976 to a depth of 1966 meters and has a bottomhole temperature of 360°C. Evaluation of the chemistry of the fluids produced indicate that recharge to the reservoir discovered by the HGP-A well is largely fresh meteoric water with smaller amounts of seawater recharge. The changes in fluid chemistry during production suggest that at least two separate aquifers are providing fluids to the well and that silica deposition is occurring in the reservoir formation. Isotopic data indicate that the fluid circulation and residence times in the reservoir are relatively short and that the heat source for this part of the rift zone is either very young or relatively large.

55660 (SGP-TR—60, pp 315-321) **Interpretation of radon concentration in the Serrazzano zone of the Larderello geothermal field.** Semprini, L. (Stanford Univ., CA); Kruger, P.; D'Amore, F. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Wellhead concentrations of radon were made at 22 wells in the south-west region of the Larderello geothermal fields by two analytical methods, a field measurement and a laboratory measurement. The radon concentrations were correlated with average specific volume of superheated steam for each well estimated from available thermodynamic parameters of the reservoir. The correlation was improved by adjusting the specific volume of steam by a mass steam saturation value calculated at the boiling front from chemical fluid composition for each well by a method developed by D'Amore and Celati. A compressible flow model for radon transport developed by Sakakura et al. was also tested. The results confirm that radon behavior in geothermal systems is characterized by thermodynamic conditions in the reservoir. In the Serrazzano zone, abnormally high values of radon concentration with respect to estimated specific volume in four of the 22 wells were observed in an area of proposed low permeability. The high values may also result from higher emanating power or lower porosity in this zone. A cross-section normal to the zone of low permeability between the two basins shows a similar radon profile as noted in a Geysers production zone. A comparison of these data with the set obtained in 1976 by D'Amore shows relatively constant radon concentration despite several wells having large variations in gas/steam ratios.

55661 (SGP-TR—60, pp 323-328) **Geochemical evidence of natural recharge in Larderello and Castelnuovo areas.** Calore, C.; Celati, R.; D'Amore, F.; Noto, P. (Istituto Internazionale per le Ricerche Geotermiche, Pisa, Italy). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The spatial variations of the isotopic composition of the fluid in Castelnuovo and the southern zone of Larderello were, in the early 1970s, interpreted as the effects of a natural recharge. It was subsequently noted that this distribution might be the result of the condensation process, at least in areas with no tritium. In order to further investigate this problem a study was undertaken of the spatial and temporal variations in the gas/steam ratio and in the isotopic composition. Preliminary interpretation of the results of this study confirms that the evolution of fluid composition in this area is due to a mixing between the fluid originally present in the reservoir and recent meteoric waters. The area affected by natural recharge is, moreover, in continual expansion.

55662 (SGP-TR—60, pp 329-334) **Thermal waters and the effect of their use on the environment.** Dvorov, I.M.; Dvorov, V.I. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A few of the many types and quantities of salt and gas components in hydrothermal waters are examined. In successive order, the chemical composition of hydrothermal fluids are considered from fresh water to brines. The undesirable effects of the thermoenergetic and chemical use of thermal waters on nature are considered. (MHR)

55663 **(USGS-OFR—78-438) Selected data from thermal-spring areas, southwestern Montana.** Leonard, R.B.; Brosten, T.M.; Midtlyng, N.A. (Geological Survey, Helena, MT (USA)). May 1978. 74p. Geological Survey, Box 25425, Federal Center, Denver, CO 80225 $9.50/MF $3.50.

During 1975 to 1977 the Montana district of the US Geological Survey collected and assembled data describing the flow, temperature, and chemical characteristics of thermal and related waters. The work was part of an assessment of the geothermal resources of southwestern Montana, excluding Yellowstone Park. Representative data are presented here from 24 thermal springs and 3 deep wells where water temperatures exceed 38°C (100°F). Initially, the data base included references reported by Waring (1965). The data base also included unpublished chemical analyses of water samples and related data collected during 1959 to 1973 by the Montana State Board of Health (now Montana Department of Health and Environmental Sciences), the Montana Bureau of Mines and Geology, and by graduate students for theses. Results of analyses and engineering reports were collected from landowners, and additional published and unpublished data were collected by Geological Survey investigators during 1967 to 1975. Tabulation of the data revealed wide discrepancies in reported parameters for some sites. Inadequate description of the sampling sites limited the value of much of the previously reported data, because most of the thermal springs were characterized by multiple outlets. Field measurements of rate, specific conductance, pH, and temperature of flow at the various outlets, particularly those having the highest temperatures, were compared with previously reported determinations.

55664 **(USGS-OFR—79-687) Chemical analyses of ground water related to geothermal investigations in the Teton River area, eastern Idaho.** Crosthwaite, E.G. (Geological Survey, Boise, ID (USA)). 1979. 17p. NTIS, PC A02/MF A01. Order Number DE84000826.

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Water samples were collected from 31 wells and springs in eastern Idaho and western Wyoming to help evaluate the potential geothermal resources in the Teton River area, Idaho. The water analyses included the common anions and cations, oxygen-18, deuterium, and several minor elements. Actual temperatures of the sampled thermal waters ranged from 23 to 49°C. Estimated aquifer temperatures, as derived from geochemical thermometers, ranged from 45 to 145°C based on silica concentrations and 45 to 205°C based on sodium-potassium-calcium ratios. Using the cation thermometer, two analyses indicated aquifer temperatures that were lower than the actual measured temperatures. Estimated temperatures using a mixing-model method ranged from 205 to 320°C, the higher temperature being of questionable value. The different methods used to estimate aquifer temperatures showed little correlation. On the basis of isotope data, the warm waters may be of local meteoric origin and have not been heated enough to react significantly with the aquifer rocks, or they originated as precipitation at high altitude and great distance from the area.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 55702, 55713

55665 (CONF-8208109—Vol.1, pp 61) **Subsidence detection at Cerro Prieto geothermal field by precision gravity studies.** Grannell, R.B.; Wyman, R.M.; Leggewie, R.M.; Randall, G.A. (California State Univ., Long Beach). 1982. NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55666 (CONF-8208109—Vol.1, pp 63-78) **Laboratory measurement related to subsidence potential-Cerro Prieto geothermal field.** Schatz, J.F. (TerraTek, Salt Lake City, UT). 1982. NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

The results of a project funded by the Lawrence Berkeley Laboratory's Geothermal Subsidence Research Project (which was, in turn, funded by the US Department of Energy's Division of Geothermal Energy) are described. The objectives of the work described here were to acquire cores and fluids from the Cerro Prieto geothermal reservoir, to test those cores for their short-term and long-term (creep) compaction response; and to develop a compaction constitutive model that would allow mathematical models to be subsequently used to predict reservoir compaction and surface subsidence for actual field occurrences.

55667 (CONF-8208109—Vol.1, pp 113-120) **Summary of geothermal brine reinjection tests without previous treatment at well M-9 of the Cerro Prieto geothermal field.** Cortez, C.; Perez, P.; Godinez, S.; Carreno, E. (Comision Federal de Electricidad, Mexico City). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55668 (SGP-TR—60, pp 67-72) **Hydrologic changes at Tauhara field due to exploitation of Wairakei field.** Allis, R.G. (Department of Scientific and Industrial Research, Wairakei, New Zealand). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The major thermal areas of Tauhara field are situated around the town of Taupo, about 8 km from the Wairakei production borefield. Within Taupo, over 400 wells have been drilled to between 30 and 150 m depth, tapping the near-surface hot water of Tauhara field for domestic heating. Analysis of many measurements made since the 1950's in both domestic wells and the hot springs of Tauhara field has failed to find evidence of a widespread decline in water level or near-surface aquifer pressure. However, a significant increase in both temperature of the near-surface aquifer, and heat flow from thermal areas of Tauhara field has occurred since the mid-1960's. This has resulted in a spread of steaming ground and 3 hydrothermal eruptions on the outskirts of Taupo. A study of pressure changes in deep wells of Tauhara field suggests a decline of around 18 bars has occurred at >400 m depth, due to exploitation at Wairakei. The deep reservoir pressure of Tauhara field is now about 7 bars higher than that of Wairakei field, and significant flow towards Wairakei production borefield is probably occurring. The lack of a significant pressure drop in the surface aquifer of Tauhara field is due to the presence of low permeability lacustrine mudstone layers covering most of the field between 100 and 400 m depth. Deep drawdown of the field has caused a steam zone to form beneath the mudstone layers, and this in turn has caused the increase in steam-heating of the surface aquifer.

55669 (SGP-TR—60, pp 97-101) **Evaluation of injection test data from a Baca well.** Riney, T.D.; Garg, S.K. (S-CUBED, La Jolla, CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Injection test data from Baca well B-20 show that half of the fluid enters a fractured zone below ~ 5000 ft whereas the primary production zone is at ~ 4000 ft. The fracture created during the subsequent stimulation of B-20 apparently intersects the lower fluid-accepting zone rather than a production zone. Fracture stimulation must provide a channel to a productive region of the natural fracture system to be effective.

55670 (SGP-TR—60, pp 177-182) **Monitoring fluid depletion at The Geysers by the gravity change/subsidence ratio.** Allis, R.G. (Department of Scientific and Industrial Research, Wairakei, New Zealand). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The ratio of gravity change to subsidence may be a useful indicator of the rate of fluid depletion in vapor-dominated reservoirs. For an average reservoir porosity less than about 10%, this ratio is close to -40 μgals/cm if there is no recharge or reinjection to the reservoir. The ratio is independent of reservoir thickness, pressure drop and porosity. If R is the fractional recharge mass (assumed to be <100°C), the ratio is reduced by a factor 1 - R/1 + 0.4 R. The rate of injection of condensate into The Geysers reservoir would reduce this ratio to between -24 to -28 μgals/cm. Analysis of the available data at The Geysers (1974 to 1977) shows the most heavily produced part of the reservoir to have a ratio of -14 μ gals/cm. This discrepancy may be significant, and could be due to a component of natural liquid recharge, or to decompression effects at the boundaries of the vapor-dominated zone. A much more negative value for the ratio is implied by the few data points in the smaller pressure sink around power plants 9 to 10, suggesting little recharge or reinjection is occurring in this area. The very small value of the ratio in the unproduced part of the reservoir could be caused by tectonic subsidence, or could be due to decompression of a predominantly liquid-dominated reservoir.

55671 (SGP-TR—60, pp 183-188) **Comparison of subsidence at Wairakei, Broadlands and Kawerau fields, New Zealand.** Allis, R.G. (Department of Scientific and Industrial Research, Wairakei, New Zealand). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Exploitation has caused over 9 m of subsidence at Wairakei since 1950, up to 30 cm at Broadlands between 1968 and 1974, and up to 25 cm at Kawerau since 1970. Despite these differences and large differences in the rate and amount of mass withdrawal, there are similarities in the pattern of subsidence at all 3 fields. In each field, pressure drawdown in the production zone can be identified as a nearly circular area of consolidation centered on the production borefield. The circular shape suggests that the predominant fault direction may not be the main factor controlling horizontal permeability. In addition to production zone consolidation, each field has a small area of relatively intense subsidence originating from shallow depth. The area of shallow consolidation is near to the natural outflow zone where geothermal water originally rose to near-surface and dispersed in highly compressible formations. Early identification of such areas in other fields is important because the high rate of consolidation at shallow depth can cause large horizontal strain and tilt of the ground surface. There is also evidence of cool groundwater inflow near the area of shallow consolidation in all three fields. Shallow reinjection into these areas may mitigate the effects of subsidence and groundwater invasion.

1507 By-products

REFER ALSO TO CITATION(S) 55643

1508 Geothermal Power Plants

55672 (DOE/ET/27026—2, pp 109-116) **Designing geothermal power plants to avoid reinventing the corrosion wheel.** Conover, M.F. (Radian Corp., Austin, TX). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

This paper addresses how designers can take into account, the necessary chemical and materials precautions that other geothermal power plants have learned. Current worldwide geothermal power plant capacity is presented as well as a comparison of steam composition from seven different geothermal resources throughout the world. The similarities of corrosion impacts to areas of the power plants are discussed and include the turbines, gas extraction system, heat rejection system, electrical/electronic systems, and structures. Materials problems and solutions in these corrosion impact areas are identified and discussed. A geothermal power plant design team organization is identified and the efficacy of a new corrosion/materials engineering position is proposed.

55673 (DOE/ET/27026—2, pp 121-124) **Shutdown corrosion in geothermal energy systems.** Ellis, P.F. II. (Radian Corp., Austin, TX). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

Experience has shown that corrosion occurring during geothermal energy utilization system downtime - shutdown corrosion - can pose a serious threat to successful operations. Shutdown corrosion in geothermal plants appears more severe than would be expected in their nongeothermal analogs, and its mitigation may pose a severe challenge to corrosion engineering personnel. Four case histories of geothermal shutdown corrosion problems are presented. General methods of mitigation are explored.

55674 (DOE/ET/27026—2, pp 133-134) **Monitoring the chemistry and materials of the Magma Geothermal Binary Cycle Generating Plant.** Shannon, D.W. (Pacific Northwest Lab., Richland, WA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

The Magma Binary Cycle plant at the East Mesa KGRA is the first geothermal generating plant of its kind in the United States. In cooperation with the Magma Electric Company, the Pacific Northwest Laboratory conducted a DOE sponsored program at the plant to document the chemistry and materials performance during the first two year of operation. The methods used, the instruments and the results are described.

55675 (DOE/ET/27026—2, pp 135-136) **Rankine cycle leak detection via continuous monitoring.** Kindle, C.H. (Pacific Northwest Lab., Richland, WA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

Rankine cycle power plants operate on a closed cycle in which heat is transferred from a high temperature reservoir to a low temperature sink while performing useful work. Leaks in this cycle cause the loss of working fluid and/or corrosion of the power plant. Both of these constitute a loss of capital assets. A severe leak can reduce the efficiency of the cycle to the extent of creating an operating loss. PNL is undertaking the development of continuous monitoring techniques to protect rankine cycle plants from such losses. The location of these continuous monitors on an organic rankine cycle is described and shown schematically.

55676 (EGG-M—00283) **Preliminary assessment of condensation behavior for hydrocarbon-vapor expansions which cross the saturation line near the critical point.** Demuth, O.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-830812—54). NTIS, PC A02/MF A01. Order Number DE84000664.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

Previous analyses of binary cycles for conversion of geothermal energy from moderate temperature resources to electrical energy have shown potential gains in net geofluid effectiveness on the order of 8%, resulting from selection of turbine-expansion processes whose equilibrium states pass through the two-phase region. If condensation occurs, this gain could be reduced or eliminated by the resulting loss in turbine efficiency. Experience with many fluids, however, indicates that vapor supersaturation permits metastable pure-vapor states to exist at temperatures considerably below the saturation temperature at a given pressure; thus, by better understanding the condensation process, and properly structuring the cycle, substantial performance gains may be possible. The purpose of the present study was to assess the probability for attaining this performance gain by estimating the extent of condensation which might be expected during such an expansion of isobutane vapor.

The study indicated that turbine performance should not be degraded significantly for the turbine expansions considered, and that a large fraction of the gain in geofluid effectiveness identified previously is potentially achievable.

55677 **(EGG-M—00383) Thermal and hydraulic performance of a sieve-tray direct-contact heat exchanger.** Mines, G.L.; Wiggins, D.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-830812—55). NTIS, PC A02/MF A01. Order Number DE84000663.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

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Experiments investigating the thermal and hydraulic performance of a sieve tray direct contact heat exchanger (DCHX) were conducted using a 275° geothermal fluid as an energy source and different hydrocarbons as working fluids. The baseline performance tests with the direct contact unit were conducted with isobutane. The thermal performance of the unit met or exceeded the design goals for individual tray thermal efficiencies and pinch points. Hydraulically the column operated near recommended design fluid velocities. Following the completion of these tests, the DCHX was operated with different mixtures of hydrocarbon working fluids. Different combinations of the isobutane/hexane family were tested followed by a series with propane/isopentane fluids. The testing conducted with the direct contact unit showed that the sieve tray column is a very efficient heat exchange device although some degradation in boiling tray efficiency and column throughput were noted when mixtures were used.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 55638, 55652, 55669, 55672, 55673, 55674, 55716

55678 (CONF-8208109—Vol.1, pp 233-244) **Criterion to determine casings deepness at Cerro Prieto.** Olivas, H.M. (Comision Federal de Electricidad, Mexico City); Vaca, J.M. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55679 (CONF-8208109—Vol.1, pp 245-261) **Geothermal well drilling manual at Cerro Prieto.** Fernandez, A.; Flores, M.; Cobo, J.M. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55680 (CONF-8208109—Vol.1, pp 285-352) **Analysis of the exploration wells in the Cerro Prieto Field and Mexicali Valley.** Cobo, J.M. (Comision Federal de Electricidad, Mexico City); Bermejo, F.J. 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55681 **(DOE/ET/27026—2) Addendum to material selection guidelines for geothermal energy-utilization systems. Part I. Extension of the field experience data base. Part II. Proceedings of the geothermal engineering and materials (GEM) program conference (San Diego, CA, 6-8 October 1982).** Smith, C.S.; Ellis, P.F. II. (Radian Corp., Austin, TX (USA)). May 1983. Contract AC02-79ET27026;AC03-81SF11503. 202p. (CONF-821075—). NTIS, PC A10/MF A01. Order Number DE83017656.

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

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The extension of the field experience data base includes the following: key corrosive species, updated field experiences, corrosion of secondary loop components or geothermal binary power plants, and suitability of conventional water-source heat pump evaporator materials for geothermal heat pump service. Twenty-four conference papers are included. Three were abstracted previously for EDB. Separate abstracts were prepared for twenty-one. (MHR)

55682 (DOE/ET/27026—2, pp 93-98) **Cathodic protection for geothermal wells.** Ohnysty, B.; Slattery, D.G.; Morris, M. (San Diego State Univ., CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

A study was conducted to determine the current requirements for cathodic protection of geothermal wells. Oil well technology was applied in this study. Results of laboratory tests and field tests are presented. Attenuation calculations indicate that the cathodic protection current determined from field tests would protect the specific individual geothermal well.

55683 (DOE/ET/27026—2, pp 99-102) **Corrosion reference for geothermal downhole materials selection: overview.** Ellis, P.F. II. (Radian Corp., Austin, TX). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

A consolidated reference of materials for downhole equipment used in geothermal energy exploitation is nearing completion. The reference is a summary of recent developments in the areas of tubular goods materials, highly alloyed metals, high temperature cements, high temperature elastomers, drilling and completion tools, logging tools, and downwell pumps. A brief overview is presented here.

55684 (DOE/ET/27026—2, pp 103-108) **Corrosivity classification system for geothermal resources.** Conover, M.F. (Radian Corp., Austin, TX). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

The most important difference between traditional steam systems and those that utilize geothermal fluids is the potential for corrosion of metals. The recently developed source book Materials Selection Guidelines for Geothermal Energy Utilization Systems is expected to facilitate corrosion engineering decision making and reduce the cost of geothermal systems where new resources are similar to those presented by the corrosivity classification system.

55685 (DOE/ET/27026—2, pp 117-120) **Materials corrosion tests applicable to a cooling system using aerated treated geothermal brine or the high saline waters associated with geothermal areas.** Suciu, D.F.; Wikoff, P.M. (EG and G Idaho, Inc., Idaho Falls). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

The results of an investigation conducted to determine the corrosion characteristics of a number of alloys in a high saline environment are discussed. The ferritic stainless steels and several copper/nickel alloys exhibited good corrosion resistance in these high saline geothermal environments.

55686 (DOE/ET/27026—2, pp 137-142) **Elastomers for service in deep well environments.** Logsdon, L.R.; Long, W.C. (BJ-Hughes Inc., Commerce, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

Efforts duplicating four compounds recommended by L'Garde and obtaining equal physical properties are detailed. Sample products using these formulations were submitted to customers for evaluation. The L'Garde formulas and the comparison in physical properties as processed by both companies are shown. (MHR)

55687 (DOE/ET/27026—2, pp 143-146) **Fabrication report on L'Garde Y267 geothermal compound.** Gillette, H. May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

A technology transfer was made from L'Garde to Precision Rubber Products for the fabrication of L'Garde geothermal seal compound Y267. Precision Rubber reports their experience as fabricators and gives field reports from three of their customers. Most of the experience has been very successful.

55688 (DOE/ET/27026—2, pp 147-152) **High-temperature Y267 EPDM elastomer field and laboratory experiences, September 1982.** Hirasuna, A.R.; Friese, G.J.; Stephens, C.A. (L'Garde, Inc., Newport Beach, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

High performance elastomers were developed for hostile geothermal environments which clearly advance the state-of-the-art. The Y267 EPDM compound is eminently successful and has accumulated broad laboratory and field test experience. Over 15 separate tests are reviewed with about 95% performed independently by other organizations. The tests include a broad spectrum of environments with temperatures in excess of 320C (608F), differential pressures up to 138 MPa (20,000 psi) and in fluids including brine, oils, isobutane, and others.

55689 (DOE/ET/27026—2, pp 153-158) **Improved energy sealing capability.** Barsoumian, J.L. (Parker Hannifin Corp., Culver City, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

In response to the need for tapping national energy resources, an improved high temperature sealing material has been developed. Parker Seal was selected as one of the technology transferees from L'Garde Inc. and has optimized this transferred technology for further improved performance capabilites and acceptable plant processing. Parker Seal's testing and evaluation efforts on L'Garde's Y267 transferred technology for a new geothermal and steam service material are summarized. This new product, Parker's E962-85 is described.

55690 (DOE/ET/27026—2, pp 159-164) **New fluorocarbon elastomers for seals for geothermal and other aggressive environments.** Dumitru, E.T.; Lagow, R.J.; Kukacka, L.E. (Exfluor Research Corp., Austin, TX). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

Geothermal brines at 600°F which contain metallic salts, H_2S, and hydrocarbons quickly degrade conventional hydrocarbon elastomers, and hydrolyse crosslinks. Carbon-carbon and carbon-fluorine bonds are expected to be superior, but no such elastomer is now commercially available. Crosslinked, perfluorocarbon elastomers were prepared by radiation crosslinking VDFHFP and TFEP (alternating) copolymers in film and sheet form, and then converting C-H bonds to C-F bonds with elemental Fluorine gas. EPDM elastomers became brittle on fluorination. The best products exceeded 100 days survival at 300°C in simulated geothermal brine. Tensile, elongation, solvent swelling, and TGA methods were used to study the products.

55691 (DOE/ET/27026—2, pp 165-170) **Pitfalls of elastomer compatibility testing.** Friese, G.J. (L'Garde, Inc., Newport Beach, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

An extensive compatibility test program was conducted starting with 34 compounds and six 190C fluids. Both immersion tests and simulation tests were conducted for time periods ranging from 46 hours to over six months. Deficiencies in both types of tests were determined. Immersion tests, while useful for reducing the number of candidate compounds, can easily lead to incorrect conclusions. It is essential that simulation tests be conducted before a final elastomer is selected for use in a critical design.

55692 (DOE/ET/27026—2, pp 171-174) **Summary of geothermal elastomeric materials (GEM) technology transfer.** Hirasuna, A.R. (L'Garde, Inc., Newport Beach, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

High temperature elastomer technology which significantly advances the state-of-the-art was developed by L'Garde under DOE sponsorship. DOE exercised foresight and sponsored direct transferral of this technology to industry. Consequently, the technology can be readily purchased today from three commercial sources in form of finished elastomeric parts. This paper provides a summary and conclusion of this effort which transcended important technology from a report gathering dust to three ready sources of elastomeric parts providing the benefits of Y267 EPDM technology.

55693 (DOE/ET/27026—2, pp 175-178) **Design and fabrication of polymer concrete pipe.** Schroeder, J.E. (Lindsey Industries, Azusa, CA); Abdelgawad, A.T.; Kukacka, L.E.; Fontana, J.J. May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

Polymer concrete is a composite material which has strength and durability characteristics greatly superior to those of portland cement concrete and better durability in hot brine than steel. Polymer concrete has been successfully tested in brine and steam at temperatures up to 260°C. Exposures were as long as 960 days. Glass filament wound polymer concrete pipe was developed with excellent strength, low weight, and a cost comparable to or less than schedule 40 steel. Connections can be made with slip joints for low pressure applications and flanged joints for high pressure applications.

55694 (DOE/ET/27026—2, pp 179-186) **Development of bushings and bearings for use in hot brine pumps.** Hosang, G.W.; Stetson, A.R. (Solar Turbines Inc., San Diego, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

The exploitation of geothermal resources often requires that naturally heated subterranean brines be pumped to the surface from depths of up to 6000 feet underground while minimizing heat losses and maintaining sufficient fluid pressure to prevent boiling. To accomplish this requires the use of downhole brine pumps capable of months of uninterrupted operation. Significant problems have occurred with pump lineshaft bearings in the geothermal wells. The objective of this research program was to determine the nature of the problems associated with commonly reported premature failures of downhole lineshaft pump bearings. Using the information gathered, a series of bearing endurance tests was performed on a variety of candidate bearing materials. These tests were accomplished using test rigs specially developed to simulate actual geothermal field conditions and to isolate specific bearing wear problems.

55695 (DOE/ET/27026—2, pp 187-196) **Durability of various cements in a well of the Cerro Prieto geothermal field.** Krause, R.F. Jr. (National Bureau of Standards, Washington, DC); Kukacka, L.E. May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

The durability of each of 16 different cements was evaluated by both room temperature compressive strength and water permeability measurements, following various periods of treatment of the cements in flowing geothermal fluid of the Cerro Prieto field of Mexico. Some of these cements were selected through a Department of Energy program to develop improved cements for geothermal well completion while the others were contributed by several other institutions interested in the tests. Two types of specimens of the cements were used in the tests: (a) 50 mm cubes which were precured 1 da in molds under water in an autoclave at 200°C and 20 MPa and (b) cement slurries which were prepared and cast in sandstone cups at the field. Through the cooperation of the Comision Federal de Electricidad a set of both types of specimens was

installed in baskets which were placed 700 m downhole a well at 214°C, and an identical set of specimens was installed in special aboveground vessels near the wellhead. Following periods of 1 da, 3 mo, 6 mo, and 12 mo, specimens were withdrawn from the geothermal treatment and divided evenly between the Instituto de Investigaciones Electricas and the National Bureau of Standards for property measurements. This paper gives the downhole results by the latter laboratory.

55696 (DOE/ET/27026—2, pp 197-202) **Polymer concrete lined pipe for use in geothermal applications.** Kaeding, A.O. (Power and Communications Systems Company, San Jose, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

A specific polymer concrete formulation was applied as a steel pipe liner in response to a need for durable, economical materials for use in contact with high temperature geothermal brine. Compressive strengths of up to 165.8 MPa were measured at ambient temperature. Compressive strengths of 24 MPa and splitting tensile strengths of 2.5 MPa were measured at about 150°C. Cost of piping a geothermal plant with PC and PC-lined steel pipe is calculated to be $1.21 million, which compares favorably with a similar plant piped with alloy steel piping at a cost of $1.33 million. Life-cycle cost analysis indicated that the cost of PC-lined steel pipe would be 82% of that of carbon steel pipe over a 20-year plant operating life.

55697 (DOE/ET/27026—2, pp 209-213) **Shape memory alloy seals for geothermal applications.** Friske, W.H.; Schwartzbart, H. (Rockwell International, Canoga Park, CA). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

A 2-year program to develop a novel temperature-actuated seal concept for geothermal applications is reported. This seal concept uses the unique properties of a shape memory alloy (Nitinol) to perform the sealing function. The several advantages of the concept are discussed. Demonstration tests of both face and shaft seals have shown that leaktight seals are feasible. Supporting materials studies have included corrosion tests in geothermal fluids, elevated temperature tensile tests, experimental electroplating, and metallographic evaluations of microstructures.

55698 **(DOE/ET/27098—2) Computer simulation of production from geothermal-geopressured aquifers. Final report, October 1, 1978-January 31, 1983.** Doherty, M.G.; Poonawala, N.A. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1983. Contract AC08-78ET27098. 230p. NTIS, PC A11/MF A01. Order Number DE83017594.

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This is the final report on research conducted to improve the technical and scientific understanding of geopressured and geothermal resources. The effort utilized a computer to interpret the results of well tests and compile data on gas solubility in brine and the viscosity of brine. A detailed computer reservoir study of a geopressured test well that had been abandoned as a dry hole but became a commercial producer of hydrocarbons is presented. A number of special topical reports pertaining to test activities performed on Department of Energy test wells (MG-T/DOE Amoco Fee No. 1 Well, Leroy Sweezy No. 1 Well, and Pleasant Bayou No. 2 Well) are appended to the report. A referenced article written under this study that appeared in the Journal of Petroleum Technology is also reproduced.

55699 **(SGP-TR—60) Proceedings of the eighth workshop on geothermal-reservoir engineering.** (Stanford Univ., CA (USA)). 1982. Contract AT03-80SF11459. 330p. (CONF-821214—). NTIS, PC A15/MF A01. Order Number DE83015865.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

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Forty-seven papers are included. Nine were abstracted for EDB previously. Separate abstracts were prepared for thirty-eight. (MHR)

55700 (SGP-TR—60, pp 73-89) **Reservoir characterization of the Ribeira Grande (Azores) field.** Mete, L. (Aquater, Spa, Italy); Rivera-Rodriguez, J. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A description is made of the geothermal system located at the Ribeira Grande area in San Miguel Island at Azores. To date, three deep wells have been drilled, two of them are considered to be productive and the other one, although capable of production, has been used as an observation well due to completion problems. One of the wells is presently connected to a 3 MW-portable power plant. A series of tests, including both production and well testing, have been conducted in order to provide a reservoir characterization of the system. Several injection falloff, two rate and multiple rate tests have been carried out, as well as a preliminary interference-type test. A description of results obtained is provided.

55701 (SGP-TR—60, pp 91-96) **Interpretation of Redondo Creek Field pressure buildup tests.** Fallon, J.B. (Union Oil Co., Santa Rosa, CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Recent pressure buildup analyses of Redondo Creek Field wells have been facilitated by identification of wellbore storage. The wellbore storage coefficient observed immediately after shut-in is controlled by the compressibility of the two-phase wellbore fluid, but the coefficient decreases when the wellbore storage is controlled by a rising liquid level. Identification of such phenomena aids in defining the correct radial flow regime of the pressure buildup response.

55702 (SGP-TR—60, pp 103-109) **Interpretation of nonisothermal step-rate injection tests.** Benson, S. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AC03-76SF00098.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Recent studies of single rate nonisothermal injection have shown that the pressure transients can be classified by one of two cases: (1) a moving thermal front dominated problem or (2) a composite reservoir problem. Analysis methods to determine the permeability thickness of a reservoir and the skin factor have been developed for both of these cases by Benson and Bodvarsson. Here, the extension of these methods to step-rate injection tests is discussed and a new method for tracking thermal fronts in injection wells is proposed.

55703 (SGP-TR—60, pp 111-113) **Measurement of permeability by injection tests.** Grant, M.A. (Department of Scientific and Industrial Research, Wellington, New Zealand). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

In fractured geothermal reservoirs, injection tests should normally be interpreted by using formation fluid viscosity, not injected water viscosity. Some injection tests cannot be simply related to formation permeability because injection increases permeability.

55704 (SGP-TR—60, pp 115-118) **Toward a two-equation method for geothermal simulation of fractured porous reservoirs.** Dougherty, D.E.; Pinder, G.F. (Princeton Univ., NJ). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AC03-80SF11489.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

In the double-porosity approach to the simulation of rigid geothermal reservoirs there are several options available in formulating the governing equations. The most basic method requires for each fluid phase the solution of four equations: the mass and energy

balances for both the fractures and the porous matrix. It is customary to sum the equations for the fluid phases to eliminate condensation terms from the equations. When a double porosity approach is employed, fracture-matrix exchange terms arise; these terms require constitutive assertions to solve the resulting equations. Alternatively, one may add the fracture and porous matrix equations together. This procedure not only eliminates the troublesome fracture-matrix exchange terms from explicit consideration but also reduces the number of dependent variables and equations. The various summation procedures result in the transfer of information to terms which usually lead to a more diffuse solution.

55705 (SGP-TR—60, pp 127-132) **Experiment in relative permeabilities and two-phase transient theory.** Grant, M.A. (Department of Scientific and Industrial Research, Wellington, New Zealand); Glover, R.B.; Killup, M.W. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A series of pressure transients were observed at BR21, a high-enthalpy well. The variation in transient behavior with enthalpy gives some indication of the form of relative permeability functions for fractured media. The consistent form of the observed transients indicates that two-phase transient observations can be used to determine reservoir parameters.

55706 (SGP-TR—60, pp 133-135) **Modified gas correction for the lip-pressure method.** Grant, M.A. (Department of Scientific and Industrial Research, Wellington, New Zealand); James, R.; Bixley, P.F. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

The lip-pressure method is the most convenient means of measuring the flow of many geothermal wells. The technique used is empirical and is based upon measurements made on wells with low content of noncondensible gas or dissolved solids. A correction was suggested by James (1970) for gas content. Recent results from wells of high gas content show that this correction must be revised. A theoretical derivation from Fauske's critical flow model partly supports the revision.

55707 (SGP-TR—60, pp 137-142) **Estimating reservoir properties and well performance using surface production data.** Hoang, V.T. (Chevron Resources Co., San Francisco, CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Reliable and sufficient welltest data is necessary for the evaluation of reservoir properties and well performance. Best results are usually obtained by monitoring downhole pressure and flow rate continuously during a transient test. However, a recurring problem for geothermal welltests has been the failure of the downhole pressure instrument in the high temperatures and hostile environments, typical of these wells. Usually an incomplete set of data or data without downhole pressure is used for analysis which provides only limited or erroneous results. This paper presents a technique of applying a wellbore simulator and a reservoir simulator sequentially to the surface data in order to simulate the downhole condition during a flowtest, thus allowing estimation of the reservoir properties and well performance. Comparisons of the estimated results and the results obtained from the conventional welltest analysis indicate that this technique can provide a good estimate of the reservoir properties and well performance when downhole data are lacking.

55708 (SGP-TR—60, pp 143-147) **Flashing flow in fractured geothermal reservoirs.** Menzies, A.J.; Gudmundsson, J.S.; Horne, R.N. (Stanford Univ., CA). 1982. NTIS, PC A15/MF A01. (CONF-821214—). Contract AT03-80SF11459.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Flashing two-phase flow can occur in fractured geothermal reservoirs when water flows toward the wellbore. The mass flow and enthalpy characteristics of wells with two-phase flow feedzones have been investigated by using a modified critical flow slip model. The model includes the effect of heat transfer from the reservoir rock to the two-phase flowing mixture. It was possible to estimate the effective fracture width of geothermal reservoir-well systems and to demonstrate under what conditions choking may occur in feedzone fractures.

55709 (SGP-TR—60, pp 149-153) **Description of geothermal reservoir simulator NSCGREATS and a preliminary simulation of the Kirishima field.** Tachimori, M. (Nippon Steel Corp., Kitakyushu City, Japan). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A numerical simulator for geothermal reservoirs (NSCGREATS) is presented that includes sub-simulator for flow in geothermal wells. The flow in reservoir is expressed on the basis of mass and energy transport in porous media. The flow toward the well in the wellblock are treated as a steady horizontal radial flow. The vertical flow in geothermal wells is expressed by a new set of correlations. NSCGREATS has been applied to a preliminary simulation of the Kirishima geothermal field. The simulation revealed several mechanisms at work in the transition of the reservoir. The important mechanisms are: (1) steam/water counterflow which forms a steam cap in shallow levels but remains liquid water at deep levels, and (2) recharging from outside of the reservoir which compensates for production to a considerable extent. It has been predicted by the simulation that an enthalpy of 1500 GJ/h may be produced by wells drilled at intervals of 200m in a main fault zone having a length of 1.2 Km.

55710 (SGP-TR—60, pp 155-160) **Numerical simulation model for vertical flow in geothermal wells.** Tachimori, M. (Nippon Steel Corp., Kitakyushyu City, Japan). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A numerical simulation model for vertical flow in geothermal wells is presented. The model consists of equations for the conservation of mass, momentum, and energy, for thermodynamic state of water, for friction losses, for slip velocity relations, and of the criteria for various flow regimes. A new set of correlations and criteria is presented for two-phase flow to improve the accuracy of predictions; bubbly flow - Griffith and Wallis correlation, slug flow - Nicklin et al. one, annular-mist flow - Inoue and Aoki and modified by the author. The simulation method was verified by data from actual wells.

55711 (SGP-TR—60, pp 237-248) **Stimulation of a hot dry rock geothermal reservoir in the Cornubian Granite, England.** Batchelor, A.S. (Camborne School of Mines Geothermal Energy Project, Cornwall, England). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

A hot dry rock geothermal reservoir has been created at a depth of 2000 m in granite. The stimulation was carried out using 40,000 m^3 (10 million US gal) from a 350 m open hole section that had been treated with a purpose-designed explosive tool. On-line seismic mapping has shown that the reservoir has developed in the direction of the maximum principal stress despite the fact tht the joint directions are not orientated in that direction. Photographic and television inspection has been used to correlate acoustic seisviewer and conventional wire logging results including observations of fracture width at the wellbore during pressurization. Downward growth of the reservoir has been observed despite the fact that the stimulation fluid was fresh water. This has been explained tentatively as predominantly shear growth because the shear stress gradient is sub-hydrostatic due to the highly anisotropic stress field. Preliminary calculations have shown that the reservoir structure has a volume of 100 to 200 million m^3 but there is no direct, low resistance flow path between the wells and the residence time is in excess of 5 days.

55712 (SGP-TR—60, pp 255-260) **Heat extraction modeling of the Stanford hydrothermal reservoir model.** Hunsbedt, A. (Stanford Univ., CA); Lam, S.T.; Kruger, P.; Pruess, K. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Three heat extraction experiments using a known-geometry rock loading and a calibration cooldown experiment for this rock loading yielded a set of useful hydrothermal reservoir production data covering a range of cooldown rates. The one-dimensional sweep model being developed for early use in hydrothermal reservoirs shows good agreement with the experimental data. A numerical model of the experimental system is under development and early predictions indicate reasonable agreement between numerical model output and experimental results. Future efforts will concentrate on improving details of the model particularly those related to experimental system heat loss characteristics. Once completed, a more detailed evaluation of the rock heat transfer process and appropriate simplified modeling approaches for use in the one-dimensional sweep model can be made.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 55657, 55658, 55659, 55662, 55699, 55712

55713 (CONF-8208109—Vol.1, pp 133-142) **Application of radioisotopic techniques in the Cerro Prieto geothermal field.** Flores, R.; Sanchez, J.J.; Terrazas, B.; Albarran, R. (Comision Federal de Electricidad, Mexico City). 1982. (In Spanish). NTIS, PC A15/MF A01.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

55714 (DOE/ET/27026—2, pp 81-86) **Calculation of the chemical behavior of highly concentrated geothermal brines.** Moller-Weare, N.; Weare, J.H. (Univ. of California, San Diego, La Jolla). May 1983. NTIS, PC A10/MF A01. (CONF-821075—).

From DOE geothermal engineering and materials program conference; San Diego, CA, USA (6 Oct 1982).

The development of a chemical equilibrium model for hydrothermal waters based on the semiempirical equations of aqueous electrolyte solutions recently introduced by Pitzer and co-workers is described. Accurate solubility predictions (usually within 5 to 10% of experimental results) can be made for ionic strengths 0 to 20m. Comparison with experimental data indicates that a theory parameterized by binary and ternary data can be used to accurately predict solubilities in much more complex mixtures. Mineral solubilities calculated with this model are compared with those calculated from other currently available models. Whereas our predictions are typically within 5%, the ion pairing models are substantially in error at low ionic strengths. Recent results parameterizing the H_2S and SiO_2 systems will be presented.

55715 (SGP-TR—60, pp 197-203) **Effects of temperature and stress on the compressibilities, thermal expansivities, and porosities of Cerro Prieto and Berea sandstones to 9000 psi and 280°C.** Contreras, E. (Instituto de Investigaciones Electricas, Cuernavaca, Mexico); Iglesias, E.; Bermejo, F. 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Matrix and bulk compressibilities and thermal expansion coefficients of Berea sandstone and of a sandstone from Cerro Prieto well M-94 were measured. A novel technique for computing porosities as functions of effective stress or temperature from uniaxial compression and thermal expansion measurements respectively was developed and demonstrated. These measurements cover the range from ambient temperature to 280°C. The data for Berea sandstone generally agree with previous results. The matrix and bulk compressibilities of the Cerro Prieto sandstone are considerably greater than those of two Imperial Valley sandstones, indicating significantly greater subsidence potential for Cerro Prieto. The porosities of the rocks studied decrease with increasing effective stress; the results indicate that porosity reductions due to pore pressure drawdown in sandstone dominated geothermal reservoirs are probably small. Porosities decrease also with increasing temperatures because grains expand at the expense of the pore volume. Porosity increases due to thermal drawdown are likely to be small in sandstone geothermal reservoirs, but greater porosity relative changes are expected for tighter sandstones.

55716 (SGP-TR—60, pp 205-210) **Effects of contamination by geothermal drilling mud on laboratory determinations of sandstone pore properties: an evaluation.** Arenas, A.; Iglesias, E.; Izquierdo, G.; Guevara, M.; Oliver, R.; Santoyo, S. (Instituto de Investigaciones Electricas, Cuernavaca, Mexico). 1982. NTIS, PC A15/MF A01. (CONF-821214—).

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

Research to evaluate formation damage related to drilling fluids used in Mexican geothermal fields was initiated. The initial work has been done on Berea sandstone for two reasons: (1) to save valuable reservoir drill cores while developing and turning experimental techniques, and (2) for comparison with results from other investigations, since Berea sandstone has been extensively studied and used in permeability impairment research. The magnitudes of permeability reductions associated with high-temperature rock/geothermal drilling fluid interactions, the possibility of restoring the unperturbed permeability to reservoir drill cores for its measurement in the laboratory were emphasized.

17 WIND ENERGY

1706 Wind Energy Engineering

55717 (PB—83-227207) **Tornado wind energy conversion system (TWECS) evaluation program. Final report.** Miller, G.; Wiley, R.; Liebowitz, B.; Brudner, H. (New York Univ., NY (USA)). Sep 1982. 136p. NTIS, PC A07/MF A01.

The study detailed in this report has three major components: the testing and optimization of TWECS wind tunnel models, the development of a realistic theoretical model of TWECS performance and the construction and field testing of a prototype TWECS. Wind tunnel testing with optimized TWECS models resulted in low power coefficients (below 3 percent). Similar results were also experienced under atmospheric tests with a large field prototype (30 feet high and 15 feet in diameter).

55718 (PNL—3499) **Covariance statistics of turbulence velocity components for wind-energy-conversion system design-homogeneous, isotropic case.** Fichtl, G.H. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 71p. NTIS, PC A04/MF A01. Order Number DE84000605.

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When designing a wind energy converison system (WECS), it may be necessary to take into account the distribution of wind across the disc of rotation. The specific engineering applications include structural strength, fatigue, and control. This wind distribution consists of two parts, namely that associated with the mean wind profile and that associated with the turbulence velocity fluctuation field. The work reported herein is aimed at the latter, namely the distribution of turbulence velocity fluctuations across the WECS disk of rotation. A theory is developed for the two-time covariance matrix for turbulence velocity vector components for wind energy conversion system (WECS) design. The theory is developed for homogeneous and iotropic turbulance with the assumption that Taylor's hypothesis is valid. The Eulerian turbulence velocity vector field is expanded about the hub of the WECS. Formulae are developed for the turbulence velocity vector component covariance matrix following the WECS blade elements. It is shown that upon specification of the turbulence energy spectrum function and the WECS rotation rate, the two-point, two-time covariance matrix of the turbulent flow relative to the WECS bladed elements is determined. This covariance matrix is represented as the sum of nonstationary and stationary contributions. Generalized power

spectral methods are used to obtain two-point, double frequency power spectral density functions for the turbulent flow following the blade elements. The Dryden turbulence model is used to demonstrate the theory. A discussion of linear system response analysis is provided to show how the double frequency turbulence spectra might be used to calculate response spectra of a WECS to turbulent flow. Finally the spectrum of the component of turbulence normal to the WECS disc of rotation, following the blade elements, is compared with experimental results.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 55879

55719 **(DOE/EI/02295—2) Advanced concepts in electric-generating-plant control.** Gould, L.A. (Massachusetts Inst. of Tech., Cambridge (USA)). Oct 1981. Contract AM01-76EI02295. 106p. NTIS MF A01. Order Number DE84001257.

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The research reported takes a different philosophical approach to the control problem. It is assumed at the outset that the limits on controls, states, outputs and control rates are explicitly known in advance. The basic synthesis technique developed in the research is called set-theoretic control because all system variables must lie within bounded sets in their respective vector spaces. The two design algorithms developed provide the user with once-through designs which yield feedback control gains and the maximum tolerable disturbance. In addition, a set-theoretic analysis is produced which points out the critical or binding variables that limit system performance. Detailed results are presented which show the application of the two main algorithms to an eighth-order power plant model. A variety of possible control actions are treated including proportional control, proportional-plus-integral control and the incorporation of limits on control rates-of-change in the design. Comparisons between the two design algorithms are made and set-theoretic control system designs are compared with classical designs and linear quadratic designs.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 55353, 55370, 55379, 55564, 55731, 56752

55720 **(ANL/EES-TM—231) Conceptual study of providing incremental peaking capability in combined-duty coal-fired power plants.** (Energotechnology Corp., Cambridge, MA (USA)). Dec 1982. Contract W-31-109-ENG-38. 364p. NTIS, PC A16/MF A01. Order Number DE84000188.

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This volume reports the results of the first part of a two phase study on the feasibility of providing built-in peaking capability in baseloaded, coal-fired power plants. The results indicate that the baseload/peaking plant can extend the use of coal, the nation's most abundant energy resource, to intermediate and peakload generation without the need for synthetic fuels or the construction of expensive coal-fired cycling plants, or energy storage plants. The b/p plant peaking capacity was estimated to be substantially less expensive than all other peaking power generation options currently available to utility planners. The total capital cost of the b/p plant's peaking capacity was estimated to range from 153 to 430 $/kW in 1982 prices. This is considerably cheaper than the cost of Coal-Fired Cycling plants (1004 $/kW), Underground Pumped Hydro plants (UPH, 850 $/kW), and Compressed Air Energy Storage plants (CAES, 709 $/kW). The levelized busbar cost of peaking power from b/p plants ranges from 50% less than the cost of power from the least expensive of the alternate technologies for 500 hours of peaking per year to 10% less expensive for 3000 hours per year. The potential benefits of the b/p plant which motivated the funding of this conceptual study have been borne out by the results. Phase II of the study will provide the impetus and confidence for further b/p plant development. It will demonstrate the generation economics of the b/p plant by simulating its operation in a typical or actual utility system. To improve the accuracy of the conceptual estimate, the design of a recently constructed coal-fired plant will be modified to incorporate the peaking features of the b/p plant concept. The detailed cost and performance data for the modified plant will be used for Phase II economic analysis.

55721 **(DOE/EIA—0421-Vol.2) Cogeneration: regulation economics and capacity. Volume 2. Economics and capacity.** Jess, M.; Mayes, F. (Oak Ridge National Lab., TN (USA); USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Sep 1983. Contract W-7405-ENG-26. 68p. NTIS, PC A04/MF A01 - GPO. Order Number DE84000132.

This report provides a framework for analysis of the role of cogeneration in providing electric generating capacity. Cogeneration can be defined as the dual production of useful thermal and power energy from a single heat source. In most applications, cogeneration is used to produce electricity and some other form of useful heat. The report has been published in 2 volumes. This volume summarizes available technologies for cogeneration of heat and electric power. It develops a theoretical model that describes the elements of an economic decision used by an industrial firm to determine whether or not an investment in cogeneration facilities would be beneficial. Once the elements in this decision have been identified, the role of the price of electricity in determining benefits is analyzed. Legislation that has established new regulatory standards for prices of electric power produced and consumed by cogeneration facilities is analyzed to provide insights into the relationship between cogeneration and regulated electric utilities. An estimate of the output of industrial cogeneration is constructed in order to provide perspective on the importance of cogeneration in supplying electricity in the United States. This analysis shows that the economic capacity decisions of cogeneration are determined by balancing the economic benefits of electricity production against increased capital and operating outlays. In this theoretical model, the outcome of the trade-off between additional benefits and costs depends critically on the price of electricity. The analysis of the FERC rules that set the price of cogenerated electricity suggests that if the rules are properly implemented, they will improve the efficiency of electric power production. However, the long-run output and distribution of benefits will depend on the dynamic processes of market adjustment.

55722 **(DOE/ET/11310—T1) Estimate of cost to construct prototype anthracite culm combustion boiler/heater units. Final technical report.** (ICARUS Corp., Rockville, MD (USA)). 15 Aug 1978. Contract AC01-78ET11310. 38p. NTIS, PC A03/MF A01. Order Number DE83018238.

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This document reports the detailed findings by ICARUS Corporation of its independent estimate of the costs to construct steam-generation plants utilizing anthracite culm fired in fluidized-bed combustors. Analyses were performed of three responses to DOE's PON FE-9 made in August 1977 by (1) the City of Wilkes-Barre, (2) the Shamokin Area Industrial Corporation, and (3) Fluidyne Engineering Corporation. Source data contained in the responses were supplemented by discussions with key personnel of Pope, Evans and Robbins (Wilkes-Barre); Curtiss-Wright, Dorr-Oliver, Stone and Webster (Shamokin); and Fluidyne. This report is organized into two major sections. The first section summarizes the cost estimates and describes the ICARUS basis for contingencies, fees and escalation rates. The second section contains three subsections, each dealing separately with the findings for each bidder.

55723 (EPRI-AP—3121, pp 1.1-1.26) **Economic-evaluation studies.** Gluckman, M. May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

The Advanced Power Systems Division of Electric Power Research Institute (EPRI) has made engineering and economic evaluations of a 1000-MW Texaco-based integrated coal-gasification combined-cycle (IGCC) power plant. Rated at 50°F, it would cost about $1300/kW and have a heat rate of 9400 Btu/kWh. Thirty-year comparative estimates and a comparison of electricity costs from coal-based units with natural gas-fired combined-cycle equipment were made. Assuming 75% operating capacity, gas-fired com-

bined-cycle plants can compete with coal plants if gas costs less than $4.50/MMBtu. The author concludes that, as plant capacities decrease, IGCC plant costs are least sensitive and nuclear plant costs are most sensitive to capacity. 5 figures, 17 tables.

55724 (EPRI-AP—3121, pp 3.1-3.27) **Coal-gasification combustion-turbine power plants emphasizing low water consumption.** Grisso, J.R. (Ralph M. Parsons Co., Pasadena, CA). May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

A summary of results is presented from a 1981 study to develop comparative performances and economics for gasification, combustion-turbine power plants designed for low water consumption. Conceptual designs, performance data, capital and operating cost estimates, and bus-bar power costs for six different configurations of coal gasification, combustion-turbine power plants using the Texaco and the British Gas Corporation Lurgi coal gasification processes were developed. Results appear to be sufficiently definitive to indicate that future air-cooled coal-gasification combustion-turbine power plants can be cost competitive with water-cooled, direct coal-fired plants while resulting in significant reductions in water consumption per kilowatt-hour generated. 5 figures, 9 tables.

55725 (EPRI-AP—3121, pp 4.1-4.35) **Cool-Water Coal-Gasification Program (CWCGP): project status.** Walter, F.B.; Skarbek, R.L. May 1983. NTIS, PC A24/MF A01. (CONF-8210170—).

From 2. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (20 Oct 1982).

Texaco's Cool Water Program is scheduled for plant startup in June 1984. By combining this program experience with the advantages of the gasification process and the combined-cycle generating system, it is expected that the pioneer commercial-scale plant to be demonstrated at Cool Water Station will serve as a foundation for larger, operational plants in the 1990s. Reviewed are program objectives, history, permit and regulatory approvals, schedule, cost and funding, organization, engineering studies, plant description, and engineering and construction status. 6 references, 7 figures, 5 tables.

55726 (ORNL/CON—123) **Protection of electric-distribution systems with dispersed storage and generation (DSG) devices.** Dugan, R.C. (McGraw-Edison Co., Canonsburg, PA (USA). Power Systems Div.). Sep 1983. Contract W-7405-ENG-26. 137p. NTIS, PC A07/MF A01. Order Number DE84000648.

The DSG protection problem areas are identified. Several simulations of protection problems are presented to show the nature of the various types of problems encountered. These simulations considered phenomena as resonance, islanding, fluctuating generation, and faults. An evaluation is made of the adequacy of present protection schemes with respect to the simulation results. Present schemes are found to be adequate in most areas except for protection against islanding. Guidelines are given to help utility distribution engineers design proper protection schemes. A special protection package for small- and medium-sized DSG installations is recommended; this would simplify interconnection of DSG with the utility system. Specifications of the package are given. The feasibilty of designing the package around a microprocessor-based relay is investigated. It is found that technical barriers have almost been overcome, and it should be practical to produce such a device soon.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 55406, 55407, 55408, 55409, 55410, 55411, 55423, 55432

55727 (CONF-8210168—, pp 245-290) **Utility flue-gas desulfurization: technology and costs.** Kaplan, N.; Princiotta, F.T. (US Environmental Protection Agency, Research Triangle Park, NC). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

In light of the limits of the low-sulfur coal and coal-cleaning options, flue-gas desulfurization (FGD) technology provides the only means of control of new utility sources, inasmuch as it is the only option commercially available by which utilities can reduce sulfur oxide emissions enough to comply with the current New Source Performance Standards (NSPS) under the Clean Air Act. For less-stringent control requirements for certain existing sources, however, low-sulfur coal and coal cleaning are viable options. The article describes the development of FGD systems and reports survey results of utility applications and costs. 4 references, 11 figures, 13 tables.

55728 **Impacts of evaporative cooling towers in arid environments.** McBrayer, J.F.; Oakes, K.M. *Journal of Arid Environments;* 5: 385-398(1982). Contract W-7405-ENG-26.

Because of competition for a limited supply of high quality water in the arid regions of the southwestern United States, electric utilities are being compelled to use saline water for evaporative cooling. Some fraction of the water passing through cooling towers inevitably is deposited on the surrounding landscape as drift. Saline drift has a potential for adverse impacts to both agriculture and natural plant communities through increased soil salinization. The potential for increased soil salinization and its impact on vegetation is assessed for cooling towers associated with two proposed energy projects in southeastern California. Severity of impact was found to be associated with the level of salinity of water in the cooling tower, effectiveness of drift eliminators, initial salinity of the receiving soils, salt tolerance of affected vegetation, and potential for removal of salts from soils, either by irrigation or precipitation.

2003 Power Transmission And Distribution

55729 (DOE/ET/29155—T1) **Resistive cryogenic cable economic-viability evaluation. Final report, Volume I.** (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). 31 Mar 1980. Contract AC01-77ET29155. 102p. NTIS, PC A06/MF A01. Order Number DE83018281.

This report presents a reassessment of the design of Resistive Cryogenic Cable Systems with regard to dielectric material selection, thermal insulation selection, conductor design, and refrigeration subsystem design. An algorithm using test data generated as part of the program and available from the literature was developed and used to assess the driving parameters for system cost analysis. The results of this cost sensitivity analysis are presented. An electric utility, Public Service Electric & Gas of New Jersey (PSE & G), performed an economic viability evaluation comparing two selected Resistive Cryogenic Cable Systems to a conventional cable system (high pressure oil-filled). The comparison was made for a 35-mile network application on the PSE & G transmission system scheduled to be placed in service in 1995. Consideration was given to equipment capital, installation, and operating costs. It was concluded that a Multilayer Vacuum Insulated Resistive Cryogenic Cable System represents a technically and economically viable alternative for the specific application studied.

55730 (DOE/ET/29297—3) **EHV high-phase-order power transmission.** Douglass, D.A.; Kallaur, E.; Stewart, J.R. (Power Technologies, Inc., Schenectady, NY (USA)). Sep 1983. Contract AC01-78ET29297. 124p. NTIS, PC A06/MF A01. Order Number DE84000927.

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This report is divided into the following topics: benefits of high phase order, EHV high phase order alternatives to UHV 3 phase transmission, mechanical design of high phase order structures, transmission line economics, economics of line terminals, combined economics of lines and stations, single pole switching, neutral shift, rate of rise of recovery voltage on circuit breakers, gradient unbalance due to ground plane, insulation design of HPO systems, line optimization results, and sample line impedances. (DLC)

55731 **(NP—3770376) Contribution to calculating characteristics of power transmission of relevance to technical reliability.** Voigt, B. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Elektrotechnik). 19 Feb 1982. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770376.

Portions are illegible in microfiche products; Thesis.

The possibilities are shown how input parameters are determined for reliability computations. This is done for the components of a transmission system and the evaluated failure statistics of an electric utility company. The following parameters of high interest to reliability engineering are treated: dependence of the failure frequency on the system's cable length, distribution of failure intervals of cables with different voltage levels, followerd by a study of influencing variables due to daily or seasonal fluctuations. Possibilities are pointed out of computing the system reliability on the basis of component parameters, and a method is presented that can be applied in the planning stage as well as during operation of energy transmission systems. Finally, the calculation of a real sub-net of a given energy supply is presented. The methodology of fault-tree analysis, implemented in several, different computer programs, is the input parameter of this section. This method is applied to determine minimum interface structures of a system, to simulating the TOP event in the fault tree and, in the method presented here, to determining the structural significance of components within a system.

55732 **(NP—3770377) Contribution to evaluating the load-dependent availability of a partial network.** Wannow, K. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Elektrotechnik). 19 Feb 1982. 142p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770377.

Portions are illegible in microfiche products; Thesis.

Two methods could be selected in a computation of the system reliability with respect to computation time and storage capacity: the component state method and the minimization method with implicants. Different day load models were compared for determining day fload fluctuations and seasonal variations. The load-dependent availability was studied in a partial network, i.e. with given day characteristics of the individual consumers. By a maintenance model, repair work strategies are worked out giving the objective function of the optimum reliability of a component with increasing failure rate. The impacts on the availability of the network could be studied by means of the outage of two transmission components, also yielding information on the load distribution in the partial network.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 55807, 55867

55733 **(NUREG/CR—3414) Evaluation of training programs and entry-level qualifications for nuclear-power-plant control-room personnel based on the systems approach to training.** Haas, P.M.; Selby, D.L.; Hanley, M.J.; Mercer, R.T. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 123p. (ORNL/TM—8848). NTIS, PC A06/MF A01 - GPO. Order Number DE84000442.

This report summarizes results of research sponsored by the US Nuclear Regulatory Commission (NRC) Office of Nuclear Regulatory Research to initiate the use of the Systems Approach to Training in the evaluation of training programs and entry level qualifications for nuclear power plant (NPP) personnel. Variables (performance shaping factors) of potential importance to personnel selection and training are identified, and research to more rigorously define an operationally useful taxonomy of those variables is recommended. A high-level model of the Systems Approach to Training for use in the nuclear industry, which could serve as a model for NRC evaluation of industry programs, is presented. The model is consistent with current publically stated NRC policy, with the approach being followed by the Institute for Nuclear Power Operations, and with current training technology. Checklists to be used by NRC evaluators to assess training programs for NPP control-room personnel are proposed which are based on this model.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 55516, 55764, 55776, 55790, 55791, 55792, 55793, 55794, 55798, 55804, 55805, 55808

55734 **(INIS-mf—8498) Nuclear power reactors.** (UKAEA Headquarters, London). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703491.

After an introduction and general explanation of nuclear power the following reactor types are described: magnox thermal reactor; advanced gas-cooled reactor (AGR); pressurised water reactor (PWR); fast reactors (sodium cooled); boiling water reactor (BWR); CANDU thermal reactor; steam generating heavy water reactor (SGHWR); high temperature reactor (HTR); Leningrad (RMBK) type water-cooled graphite moderated reactor. (U.K.).

55735 **(INIS-mf—8507) Layout of the primary circuit with its components for PWR and BWR.** Meyer, P.J. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1981. 55p. (CONF-8109220—40). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703495.

From IAEA interregional training course on nuclear power plant operational safety; Karlsruhe, F.R. Germany (7 Sep 1981).

The light water-moderated and cooled pressurized water reactors and boiling water reactors constitute the basis of economic utilization of nuclear energy all over the world. Pressurized water reactors up to capacities of 3,800 MWth are those most used for power generation. However, their potential capacities exceed 3,800 MWth, so that already in the near future PWR are conseivable which readily generate 1,500 to 2,000 MWe. The main problem for starting the next generation of PWRs are of safety measure and licensing questions. Interesting applications of the PWRs are nuclear district heating, generation of process steam of desalination plants, steam injection into the ground for oil production or chemical factories. A new generation of natural circulation boiling water reactors with a capacity of 200 to 400 MW will be used for development of small industrial areas or for countries without an integral grid system. The natural circulation boiling water reactor will be subject of a separate lecture. Due to the fact of the majority of the PWR all over the world this lecture will discuss mainly PWR design aspects. (orig./RW).

55736 **(NUREG/CP—0043) Joint NRC/ANS meeting on basic thermal-hydraulic mechanisms in LWR analysis.** Hsu, Y.Y.; Lee, R. (comps.). (Nuclear Regulatory Commission, Washington, DC (USA)). Apr 1983. 649p. (CONF-820962—). NTIS, PC A99/MF A01 - GPO $13.00. Order Number DE83902053.

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

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Separate abstracts were prepared for 18 papers in this conference proceedings. Three papers are also included in the proceedings that were previously abstracted for EDB. (LEW)

55737 **(NUREG/CR—3416-Vol.1) Evaluation of power-reactor fuel-rod-analysis capabilities. Phase 1 topical report. Volume 1. Data evaluation.** Coleman, D.R.; Harrison, D.L. (Control Data Corp., Rockville, MD (USA)). Sep 1983. 106p. NTIS, PC A06/MF A01 - GPO $5.00. Order Number DE84900062.

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The acquisition, review, analysis, and processing of power reactor fuel performance data resources is described in this report. These data resources are characterized here to support subsequent evaluations of the NRC-sponsored fuel rod behavior code, FRAPCON. Application of the Fuel Performance Data Base is shown to provide the basic data files which are sorted, processed, and restructured to establish key parameters of interest on an individual rod basis. The design, operational, and performance parameters are analyzed to determine the data populations and the representation

of various fuel design types in the data sample. Also presented are the performance data distribution and trends relative to operational parameters such as power and burnup, and a description of the data processing methods. Significant amounts of power reactor fuel performance data are available to support high burnup code evaluation studies. The data clearly indicates the cumulative effects of rod deformation and fission gas release which tend to alter the as-built fuel rod thermal and geometric conditions.

55738 **(NUREG/CR—3416-Vol.2) Evaulation of power-reactor fuel-rod-analysis capabilities. Phase 1 topical report. Volume 2. Code evaluation.** Coleman, D.R. (Control Data Corp., Rockville, MD (USA)). Sep 1983. 87p. NTIS MF A01 - GPO $4.50. Order Number DE84900061.

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FRAPCON-2 (V1M4) was applied to generate fuel performance predictions for 60 rods of a recently evaluated power reactor data sample. Rod design, operational, and performance data was obtained from the RPRI Fuel Performance Data Base. The data was systematically processed to generate code input parameters. FRAPCON was initially applied for scoping studies to identify the best estimate mechanical response and fission gas release modeling options. Based on final scoping results, the balance of rods were analyzed with FRACAS-2 mechanics and FASTGRASS gas release models. Comparisons between measured and calculated fuel and cladding deformation, fission gas release, internal pressure, and gas composition are presented and interpreted relative to code error magnitudes, distributions, and trends versus rod design and operating parameters. The results indicate the FRAPCON-2 has best estimate capability for analysis of moderate duty fuel rod performance, provided that rod fabrication parameters are well characterized, and the fuel is dimensionally stable.

55739 **(PNL-SA—11598) Manpower and staffing in nuclear power plants.** Wood, M.T. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Aug 1983. Contract AC06-76RL01830. 9p. (CONF-8308100—6). NTIS, PC A02/MF A01. Order Number DE84000479.

From 91. annual meeting of the American Psychological Association; Anaheim, CA, USA (27 Aug 1983).

Manpower and staffing requirements are seen by both nuclear industry regulators and the industry itself as central to maximizing safe operations. Since the Three Mile Island accident, attention has focused on how many people are needed to run plants safely, what their qualifications should be, and what work they are expected to perform - all focuses within the personnel subsystem of this safety model. Research projects being conducted at Battelle on these issues represent an integrated approach to the problem of identifying safety-related manpower levels, staffing practices, work schedules and staff qualifications. The purpose of this initial investigation was to describe manpower and staffing practices that reflect the approaches and activities that utilities use, and problems that they experience, in staffing their nuclear plants.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 55516, 55734, 55735, 55736, 55737, 55738, 55739, 55764, 55772, 55776, 55782, 55783, 55786, 55789, 55790, 55795, 55796, 55797, 55799, 55800, 55801, 55802, 55803, 55804, 55805, 55806, 55808, 55977

55740 **(BNL-NUREG—33618) Characterization of TMI-type wastes and solid products.** Swyler, K.J.; Dodge, C.E.; Dayal, R. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 12p. (CONF-8308106—6). NTIS, PC A02/MF A01 - GPO. Order Number DE83018291.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

Self-irradiation from sorbed radionuclides may affect properties of radwaste containing organic ion-exchange resins. Effects of gamma irradiation on cation (Amberlite IRN-77), anion (Amberlite IRN-78) and mixed bed (Amberlite IRN-150) resins have been studied under conditions relevant to radwaste management. Sulfate ion is produced by the radiolytic scission of the cation resin functional group. Sulfate yields are not strongly dependent on pH conditions, resin chemical loading, or radiation dose rate, although radiation damage is reduced in dried resins. Acidity resulting from a given sulfate yield does depend on resin counter-ion loading; mechanisms are considered. In particular for heavy irradiation doses, use of cation and anion resin in a mixed bed does not prevent radiolytic acid formation. Irradiated anion resin may also release free liquid. The significance of these and other radiolysis effects in radwaste generated under off-normal conditions is discussed.

55741 **(DOE/ET/34014—8) Extended Fuel Burnup Demonstration Program. Semiannual technical progress report, July 1982-December 1982.** Moss, H.D. (comp.). (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.; Virginia Electric and Power Co., Richmond (USA)). Jun 1983. Contract AC02-79ET34014. 102p. (WCAP—10312). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84000241.

This report describes progress made during the period of July through December 1982 on the Cooperative Extended Fuel Burnup Demonstration Program. The program is a study of the feasibility of increasing the region average discharge burnup of PWR fuel assemblies to values exceeding 40,000 MWD/MTU as part of the normal fuel cycle, and includes both generic technical studies and fuel performance data acquisition. Fuel utilization measures have been calculated for comparison of the fuel cycles, and a comparison of two burnable absorber (BA) types has been performed. Nuclear parameters determining reactor safety under accident conditions have been evaluated for the last two transition cycles. Fuel rods from the demonstration assembly have been selected and preparations made for onsite evaluation. Criticality analyses of new fuel storage racks were performed to determine whether reracking would be necessary for PWR plants, and BWR plants. Laboratory tests have led to selection of electronic equipment for and final detailed design of the burnup meter. Studies of three fuel shipping casks indicated their capabilities for transporting extended burnup fuel.

55742 **(GEND—033) Use of multi-element beta dosimeters for measuring dose rates in the TMI-2 containment building.** Scherpelz, R.I.; Endres, G.W.R.; Rathbun, L.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC07-76ID01570. 108p. NTIS, PC A06/MF A01. Order Number DE84000519.

The use of thermoluminescent dosimeters (TLDs) for beta dosimetry has traditionally involved inaccuracies due to the energy-dependent response of the TLDs. In order to correct for the beta energy spectrum, researchers at the Pacific Northwest Laboratory (PNL - operated by Battelle Memorial Institute) have developed a dosimeter using TLDs under a number of different thickness of aluminum shields. The PNL multi-element beta dosimeter has been used in four-element and seven-element configurations. Design considerations, analysis procedures, quality assurance, and error determinations for the dosimeters are described in this report. The methods of data analysis used for converting TLD response to dose are also described. These multi-element dosimeters have been used to measure beta and gamma doses resulting from radioactive contaminants in the Three Mile Island Unit 2 containment building. Over 100 dosimeters have been used in three sets of experiments at a number of locations in the building. This report documents the experiments and presents the doses evaluated by the dosimeters.

55743 **(INIS-BR—57) Design of a PWR emergency core cooling simulator loop.** Melo, C.A. de. (Minas Gerais Univ., Belo Horizonte (Brazil). Escola de Engenharia). Dec 1982. 187p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780015.

The preliminary design of a PWR Emergency Core Cooling Simulator Loop for investigations of the phenomena involved in a postulated Loss-of-Coolant Accident, during the Reflooding Phase, is presented. The functions of each component of the loop, the design methods and calculations, the specification of the instrumentation, the system operation sequence, the materials list and a cost assessment are included. (Author).

55744 (INIS-mf—8443(Vol.1-3)) **Sizewell 'B' PWR reference design.** (National Nuclear Corp. Ltd., London (UK)). Apr 1982. 986p. NTIS (US Sales Only), PC A99/MF A01. Order Number DE83703493.

The reference design for a PWR power station to be constructed as Sizewell 'B' is presented in 3 volumes containing 14 chapters and in a volume of drawings. The report describes the proposed design and provides the basis upon which the safety case and the Pre-Construction Safety Report have been prepared. The station is based on a 3425MWt Westinghouse PWR providing steam to two turbine generators each of 600 MW. The layout and many of the systems are based on the SNUPPS design for Callaway which has been chosen as the US reference plant for the project. (U.K.).

55745 (INIS-mf—8477, pp vp) **Examples of applications of MSCD mobile system in acoustic emission testing of pressure vessel material for integrity.** Sladky, J. (Skoda, Plzen (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A10/MF A01. (CONF-8105221—).

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

Measurements on pressure vessels were carried out using the MSCD system by Trodyne installed in an Avia van. The measurements were conducted on thick and thin-walled experimental vessels to rupture, on an experimental pressure vessel which had been designed for pressure tests of hydraulic and actual lids of V-213 nuclear reactors and on the first pressure vessel of the WWER-440 type reactor manufactured at SKODA in Plzen. (M D.).

55746 (NUREG/CP—0043, pp 385-415) **Initiation of waterhammer in horizontal and nearly horizontal pipes containing steam and subcooled water.** Bjorge, R.W. (General Electric Co., Lynn, MA); Griffith, P. Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

Localized slug formation from a stratified flow of steam and subcooled water in a pipe traps a steam bubble, which collapses rapidly, causing a waterhammer. This phenomenon was studied experimentally at low pressures. Several tests were performed, including measurement of the critical conditions for waterhammer initiation. An analytical model has been developed which can be used to predict whether waterhammer initiation will occur for given flow conditions. Predictions of this model agree well with experimental results. The use of the model in evaluating the susceptibility of a piping system to condensation waterhammer is described.

55747 (NUREG/CP—0043, pp 417-443) **Experimental investigation of reflood heat transfer in the wake of grid spacers.** Ihle, P.; Rust, K. (Institut fuer Reaktorbauelemente, Karlsruhe, Germany). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

A transient thermal-hydraulic experiment over realistic ranges of system parameters in a simulated fuel rod bundle is reported in the hope of gaining an insight into the most important heat transfer mechanisms which are responsible for the development of the cladding temperature transient. The enhanced mist cooling downstream of grid spacers has been identified as one of such mechanisms on the assumption of the entrainment of small droplets generated from large droplets in the flow which are intercepted by the grid spacers located at distributed intervals along the whole length of the bundle. This concept is supported by reported results of a recent LDA velocity and size measurement of droplet size-population distributions across a grid spacer plate. A suggested form of correlation for enhanced droplet heat transfer can lead to results readily useful for incorporation in the existing analytical codes for the improved prediction of thermal-hydraulic behavior of LOCA reflood of pressurized water reactors.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 55734, 55764, 55788, 55811, 56101

55748 (GA-A—17146) **New mathematical method for the solution of gas-gas equilibria with special application to HTGR primary-coolant environments.** Bongartz, K. (GA Technologies, Inc., San Diego, CA (USA)). Jul 1983. Contract AT03-76ET35301. 36p. NTIS, PC A03/MF A01. Order Number DE84000300.

A new mathematical method and corresponding computer program have been developed that provide a general method for the numerical solution of an equilibrium problem involving the chemical interactions of gaseous species. The method and computer code were developed to calculate the equilibrium concentrations of impurity gases, such as CO, CO_2, H_2, H_2O, CH_4, and O_2, which may be approached as the result of gaseous chemical reactions occurring within the hot primary coolant helium of a high-temperature gas-cooled reactor (HTGR). The method, however, can be applied to any gas mixture.

55749 (Juel-Spez—179) **Investigation of a DUPLEX-reformer tube in EVA I.** Fedders, H.; Riensche, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Nov 1982. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83751024.

In EVA I a double walled reformer tube (duplex tube) was investigated. The main question concerned the heat transfer in the gap between outer and inner wall. Starting with the measured helium and process gas temperatures and the heat fluxes the temperatures and heat transfer coefficients of the gap could be evaluated by means of well known heat transfer correlations. The measured gap width reached values up to 2 mm. Thereby calculated heat transfer coefficients amount to about 1300 W/m^2K in good agreement with the measured values. The special construction of the duplex tube prevents largely the hydrogren permeation through the outer tube wall into the helium system. The hydrogren enrichment of the helium flowing through the gap was measured gaschromatographically. The hydrogen permeation rate through the inner tube wall decreased within a few days by more than one order of magnitude in agreement with present results on tube segments.

55750 (Juel-Spez—181) **Thermodynamic and depressurization experiments at an angular bellows under cyclic movement in helium at temperatures up to 1000°C and at a pressure of 35 bars.** Lang, H.; Klas, E.; Schumacher, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Oct 1982. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751025.

By order of the Interatom Ltd., Mannesmann-Anlagenbau in Duesseldorf constructed a tube with internal insulation for the HTGR component test facility (KVK I) of Interatom. The test section with a diameter of the pressure tube of approx. 700 mm and a length of approx. 3000 mm contained an axially fixed bellows designed for an internal pressure of 40 bars. An angular movement of the test tube of +- 1.75 deg. was possible. In the region of the pressure resistant bellows a sleeve plated with oxide ceramics and above the fixed seat an axial compensator was integrated in the gas duct which had an internal diameter of 250 mm. In the depressurization test facility of the IRB of the KFA the test section was tested in Helium at pressures up to 35 bars and temperatures between 650 and 1000°C. At each temperature level of approx. 650, 800, and 950°C the test tube was bent 200 times. Six depressurization experiments were carried out. The results endorse the design data. The depressurization had no influence on the quality of the insulation. The sleeve plated with oxide ceramics and the fixed seat were the weak components. They will have to be redesigned.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 55734

55751 **(INIS-mf—8574) Halden reactor project. Twenty second annual report.** (Nuclear Energy Agency, 75 - Paris (France)). 1981. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780018.

Accomplishments realized during 1981 are summarized in this report. Reactor safety considerations continue to be the prime motivation for the Halden fuel programme. A major part of the experimental efforts deal with effects of loss-of-coolant accidents (LOCA) on fuel thermal and dimensional response. Fuel defect mechanisms and probabilities, both during safety related accident sequences and in response to operational transients, are also extensively studied. The programme encompasses current fuel designs as well as design modifications expected to improve performance. The Halden Project is expanding its work on process computer applications with emphasis on operator-process communication and operator guidance systems. This includes human factors experiments, control room layout and design, alarm handling systems and core surveillance. The principal tool being developed for performing realistic experiments in this field is the new control room with a full scope training simulator model of a nuclear power plant.

55752 **(INIS-mf—8576) Halden reactor project. Twenty first annual report.** (Nuclear Energy Agency, 75 - Paris (France)). 1980. 62p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780019.

The research programme at the Halden Project is focused on the following three areas: 1. In-core behavior of reactor fuel, particularly reliability and safety aspects, which is studied through irradiation of test fuel elements. 2. Prediction, surveillance and control of fuel and core performance for which models of fuel and core behavior are developed. 3. Applications of process computers to power plant control, for which prototype software systems and hardware arrangements are developed.

2105 Power Reactors, Breeding

55753 **(INIS-mf—8485) Fast reactor.** (UKAEA Headquarters, London). 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703496.

The subject is discussed as follows: brief description of fast reactors; advantage in conserving uranium resources; experience, in UK and elsewhere, in fast reactor design, construction and operation; safety; production of plutonium, security aspects; consideration of future UK fast reactor programme. (U.K.).

55754 **(INIS-mf—8486) Fast reactors: potential for power.** (UKAEA Headquarters, London). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703497.

The subject is discussed as follows: basic facts about conventional and fast reactors; uranium economy; plutonium and fast reactors; cooling systems; sodium coolant; safety engineering; handling and recycling plutonium; safeguards; development of fast reactors in Britain and abroad; future progress. (U.K.).

55755 **(LA—9769-PR) Examination of fast-reactor fuels and FBR analytical quality-assurance standards and methods. Progress report, January 1-March 31, 1983.** Maraman, W.J. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE84000124.

This is the thirty-fourth quarterly report of the Examination of Fast Reactor Fuels and Fast Breeder Reactor (FBR) Analytical Quality-Assurance Standards and Methods at the Los Alamos National Laboratory. Most of the investigations discussed here are of the continuing type. Topics discussed include: examination of fast reactor fuels; and FBR analytical QA standards.

55756 **(ORNL/TM—8892) Clinch River Breeder Reactor: an assessment of need for power and regulatory issues.** Hamblin, D.M.; Tepel, R.C.; Bjornstad, D.J.; Hill, L.J.; Cantor, R.A.; Carroll, P.J.; Cohn, S.M.; Hadder, G.R.; Holcomb, B.D.; Johnson, K.E. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 191p. NTIS, PC A09/MF A01. Order Number DE84000297.

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The purpose of this report is to present the results of a research effort designed to assist the US Department of Energy in: (1) reviewing the need for power from the Clinch River Breeder Reactor (CRBR) in the Southeastern Electric Reliability Council (SERC) region, not including Florida, and (2) isolating specific regulatory and institutional issues and physical transmission capacities that may constrain the market for CRBR power. A review of existing electric power wheeling arrangements in the Southeast and specific federal and state regulatory obstacles that may affect power sales from the CRBR was undertaken. This review was a contributing factor to a decision to target the service territory to SERC-less Florida.

55757 **(PB—83-200444) Optimization technique applied to interpretation of experimental data and research of constitutive laws.** Grossette, J.C. (Commission of the European Communities, Luxembourg). [nd]. 132p. (EUR—7836-EN). NTIS, PC E07/MF E07.

As there are uncertainties as to the effect of boundary conditions on a specimen in tension, the conditions under which Hopkinson-Davies formulae may safely apply at high strain rates are examined. The formulae are to be considered as only rough approximations for the specimen while the classical uniaxial wave theory suffices for the pressure bars. A more precise description requires a division of the specimen's response into four time-domains to account for the appearance and growth of plastic zones and progressive anisotropy. Successive iterative comparisons using a well selected criterion function enable the response of a mathematical model to be modified in order to agree with experimental results. Such models are intended to be incorporated into the structural dynamic codes used to evaluate fast reactor containment and for subassembly analysis.

55758 **(ANL-Trans—1209) Transposition to scale 1 of the acoustical criterion determined on Model Pump SPX 1. Comparison with test results of the RCP - C primary pump done at Gennevilliers: test on reduced model SPX 1.** Courbiere, P.; Defaucheaux, J.; Jeumont-Schneider, J.M. (Argonne National Lab., IL (USA)). Dec 1982. Contract W-31-109-ENG-38. Translation of French Internal Report 82 RLN 064. 22p. NTIS MF A01. Order Number DE83016299.

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In the framework of the CEA-JS component accords on pumps, the GAN/RLN [Nuclear Activities Group] at Jeumont Nord and the DRNR/STRS/SDER [Sodium Reactor Technology Department, Reactor Equipment Development Division] at the Cadarache CEN [Nuclear Research Center] have a common test program in water on the SPX1 model installed at Jeumont. This note presents the extrapolation, to Scale 1, of the results of tests in water at 22°C and at 52°C obtained on the model pump SPX1 of Jeumont-Schneider at Jeumont (Nord). These scale effects are compared with the results obtained at Gennevilliers on the RCP-C primary pump of the Super Phenix in order to verify whether an acoustical criterion determined from a model can help with dimensioning to Scale 1.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

55760 **(ESG-DOE—13407) Space-reactor system and subsystem investigations: cost and schedule estimates for reactor and shield subsystems technology development. SP-100 Program.** Determan, W.R.; Harty, R.B.; Hylin, C. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 30 Jun 1983. Contract AT03-82SF11687. 13p. NTIS, PC A02/MF A01. Order Number DE84000112.

This report presents cost and schedule estimates of the technology development for reactor and shielding subsystems of a 100-kWe class space reactor electric system. The subsystems technology development (which includes reactor and shield subsystems ground testing) is supported by materials and processes development and component development. For the purpose of the cost estimate, seven generic types of reactor subsystems were used: uranium-zirconium hydride, NaK-cooled thermal reactor; lithium-cooled, refractory-clad fast reactor; Na- or K-cooled fast reactor; in-core thermionic reactor; inert gas-cooled particle fuel reactor; inert gas-cooled metal-clad fast reactor; and heat pipe-cooled fast reactor. Also three levels of technology were included for each of the generic types of reactor subsystem: current, improved, and advanced. The data in this report encompass all these technology levels. The shielding subsystem uses both gamma (heavy-metal) and neutron (hydrogenous material) shields. The shields considered in this report would be used in conjunction with unmanned payloads.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 55875

55762 **(INIS-mf—8508) Safety philosophy and licensing practice in different member states of IAEA: France.** Guimbail, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1981. 16p. (CONF-8109220—41). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703514.

From IAEA interregional training course on nuclear power plant operational safety; Karlsruhe, F.R. Germany (7 Sep 1981).

After a presentation of EDF organization to face the French nuclear programme, the lecture describes the different actions under EDF responsibility during the design, construction, commissioning and operational phases of a nuclear power plant. The lecture is concluded by an identification of the main safety topics identified by EDF as the most sensitive such as feed-back of operational experience, improvement of the knowledge of postaccidental conditions. A particular effort is devoted by EDF to improve them. (orig./RW).

55761 **(INIS-mf—8509) Safety philosophy and licensing practice in different member states of IAEA: Germany, F.R.** Lahner, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1981. 20p. (CONF-8109220—42). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703515.

From IAEA interregional training course on nuclear power plant operational safety; Karlsruhe, F.R. Germany (7 Sep 1981).

The safety philosophy, as the basis of the design of a NPP, will be shown under the aspects of general design rules, requirements by law, reactor safety commission and nuclear or conventional technical standards. Then a discussion of the licensing practise in the Federal Republic of Germany and in the USA will follow for the different stages of conceptual design, construction and operation with special consideration of the example of the NPP Muelheim-Kaerlich. The interrelation between designer and licensing authority, reactor safety commission and technical consultants will be taken into account. (orig./RW).

55762 **(INIS-mf—8510) Legal aspects of nuclear energy.** Kraut, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1981. 47p. (CONF-810220—43). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703516.

From HDR workshop on state-of-the-art in modeling; Santa Barbara, CA, USA (5 Feb 1981).

The legal basis for the use of nuclear energy is generally given by an Atomic Energy Act. Additionally, however, a system of regulations and standards has to be set up to lay down more detailed requirements. The fundamental philosophy and strategy has to be specified by governmental organizations. For the specification and implementation of the requirements some minimum organizational arrangements are necessary, which are not only restricted to governmental organizations. Furthermore procedural regulations have to be laid down before the implementation phase. This includes aspects like public participation in the licensing procedure. In practice, however, the implementation of the legal requirements always shows some weakness of the basic legal requirements. To learn from this experience some examples are presented, which gave rise to difficulties in the implementation procedure. (orig./RW).

55763 **(INIS-mf—8511) Safety philosophy and licensing practice in different member states of IAEA: Spain.** Alonso, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1981. 45p. (CONF-8109220—44). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703517.

From IAEA interregional training course on nuclear power plant operational safety; Karlsruhe, F.R. Germany (7 Sep 1981).

With the aim of presenting the licensing experience in Spain, the countries with nuclear activities are divided into three main groups: exporters, qualified importers and importers, being Spain in the second group. The licensing problems, and therefore the licensing experience, are different in the different groups of countries. Moreover, the experience in Spain is enriched by the following facts: an early start, a substantial program and a diversity of types, pressurized and boiling water reactors, and suppliers, American and German plants. Reference is made to the basic legal documents governing licensing in Spain, together with the difficulties in adopting and applying detailed regulations. Within this framework, the licensing experience in Spain is described with reference to the reference plant concept, later enlarged to include the reference-site reference plant concept, ending in the most practical approach of the reference problem concept. Finally specific licensing problems are introduced with reference to the Spanish operating nuclear power plants, the ones under commissioning and in an advanced state of construction and the ones just staring construction. (orig./RW).

55764 **(NUREG—0020-Vol.7-No.6) Licensed operating reactors: status summary report, data as of May 31, 1983. Volume 7, No. 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jun 1983. 395p. NTIS, PC A17/MF A01 - GPO. Order Number DE84900068.

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The US Nuclear Regulatory Commission's monthly Licensed Operating Reactors Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

55765 **(NUREG—0750-Vol.17-No.4) Nuclear Regulatory Commission issuances. Volume 17, No. 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration). Apr 1983. 215p. NTIS, PC A10/MF A01 - GPO. Order Number DE84900070.

This report includes the issuances received during the specified period from the Commission (CLi), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

2108 Economics

REFER ALSO TO CITATION(S) 55735, 55778, 55779, 56752

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

55766 (KFK—3481) Report on research and development activities in 1982 of the Institut fuer Neutronenphysik und Reaktortechnik. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Feb 1983. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751012.

The Institute for Neutron Physics and Reactor Technology is concerned with research tasks of nuclear engineering, mainly in connection with the development of sodium-cooled fast breeder reactors and with the fusion reactor technology. The activities are in about equal parts of experimental and theoretical nature. The greater part of the research work is carried out in co-operation with other institutes and industrial groups as part of projects. For the Fast Breeder Reactor Project the Institute is working on reactor-physical design and safety questions of the core of large-scale fast breeder reactors. Questions concerning the effects of accidents with lightwater reactors upon the environment and the population are treated as part of the Nuclear Safety Project. The Institute participates in the Reprocessing Project by doing calculations on the physics of the fuel cycle and by developing monitoring devices for a reprocessing plant which are based on neutron counting. As part of the Fusion Project the Institute deals with neutron physical and technological questions of the breeder blanket. As project-independent institutional work, technical and physical questions on fusion by inertial confinement are treated. Furthermore the application of nuclear energy in the field of traffic with hydrogen as energy source is studied.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 55976, 55978, 55979, 56049

55767 (INIS-mf—8477, pp vp) MSCD acoustic emission testing system. Slama, K. (Skoda, Plzen (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A10/MF A01. (CONF-8105221—).

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

The system is described for measuring, localizing and evaluating the sources of acoustic emissions. This is the MSCD system by Trodyne (USA), built into an Avia van. It is mainly used for pressure tests of nuclear reactor pressure vessels. (M.D.).

55768 (INIS-mf—8477) Mobile measuring systems. National seminar MOMES 81. (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). [nd]. 203p. (In Czech). (CONF-8105221—). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780003.

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

Separate abstracts are presented for each of the papers included in the data base.

55769 (INIS-mf—8478) Mobile measuring systems. Supplement. Grof, V. (ed.). (Skoda, Plzen (Czechoslovakia). Zavodni Pobocka Ceske Vedeckotechnicke Spolecnosti). [nd]. 42p. (In Czech). (CONF-8105221—Suppl.). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780004.

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

Separate abstracts are presented for each of the papers included in the data base.

55770 (NUREG/CP—0043, pp 445-475) Spacer grid heat transfer effects during reflood. Chiou, J.; Hochreiter, L.E.; Utton, D.B.; Young, M.Y. (Westinghouse Corp., Pittsburgh, PA). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

Models to calculate the effects of spacer grids on core flow in the BART reflooding code are developed, including single-phase heat transfer enhancement, two-phase grid heat transfer, and droplet breaking. (LEW)

2203 Fuel Elements

REFER ALSO TO CITATION(S) 56231

55771 (INIS-mf—8499) Plutonium. (UKAEA Headquarters, London). 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703528.

The subject is discussed under the headings: creation (fuel cycle, Pu formed in thermal reactors); properties; Pu in fast reactors; fast reactor experience; radioactivity; handling; Pu and weapons. (U.K.).

2204 Control Systems

REFER ALSO TO CITATION(S) 56231

55772 (INIS-mf—8477, pp vp) Application of data processing technology in start-up of V-1 nuclear power plant - possible use of mobile computers. Gese, A.; Martancik, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). [nd]. (In Slovak). NTIS (US Sales Only), PC A10/MF A01. (CONF-8105221—).

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

The application is described of the RPP-16S control computer system in the physical and power start-up of the reactor. The following technological variables were recorded: temperature, pressure, pressure gradients, power outputs, turbogenerator speed, neutron fluxes, coarse and fine positions of the reactor control and protection system assemblies and the state of selected unit protection facilities. The structure and wiring are described of the hardware. The basic principles of software writing are described. The individual program modules which may be combined and operatively interchanged are briefly described. (M.D.).

55773 (INIS-mf—8477, pp vp) Application in measurements of SKODA-OZES mobile measuring system. Grof, V.; Drab, F.; Icha, K. (Skoda, Plzen (Czechoslovakia)) (and others). [nd]. (In Czech). NTIS (US Sales Only), PC A10/MF A01. (CONF-8105221—).

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

A mobile digital measuring system was built at SKODA - Energeticke strojirenstvi based on digital information system CIS 3000 with the ADT 4100 computer. The system can operate in the BCS or in the RTE-C mode. Two programs are briefly described written for the purpose of measurements. The following applications of the system were tried: testing the reactivity meter on the reactor model, demonstration measurement of the temperature of the medium and display of values on the monitor, measurement of the temperature of the lid of the pressure vessel of the WWER-440 reactor during overlaying and measurement and the adaptive control of band thickness on a KVARTO 200 rolling mill. The measurement system is expected to be used in nuclear power plants and experimental reactors. (M.D.).

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 55500, 56368

2206 Research, Test, And Experimental Reactors

55774 **(CONF-821155—10) Fuel-cycle cost comparisons with oxide and silicide fuels.** Matos, J.E.; Freese, K.E. (Argonne National Lab., IL (USA)). 1982. Contract W-31-109-ENG-38. 27p. NTIS, PC A03/MF A01. Order Number DE83017336.

From International meeting on research and test reactor core conversions from HEU to LEU fuels; Argonne, IL, USA (8 Nov 1982).

This paper addresses fuel cycle cost comparisons for a generic 10 MW reactor with HEU aluminide fuel and with LEU oxide and silicide fuels in several fuel element geometries. The intention of this study is to provide a consistent assessment of various design options from a cost point of view. Fuel cycle cost benefits could result if a number of reactors were to utilize fuel elements with the same number or different numbers of the same standard fuel plate. Data are presented to quantify these potential cost benefits. This analysis shows that there are a number of fuel element designs using LEU oxide or silicide fuels that have either the same or lower total fuel cycle costs than the HEU design. Use of these fuels with the uranium densities considered requires that they are successfully demonstrated and licensed:

2207 Plutonium And Isotope Production Reactors

55775 **Studies on biologically induced corrosion in heat exchanger systems at the Savannah River Plant, Aiken, SC.** Pope, D.H. (Rensselaer Polytechnic Inst., Troy, NY); Soracco, R.J.; Wilde, E.W. *Materials Performance;* **21**: No. 7, 43-50(Jul 1982). Contract AC09-76SR00001.

Biological fouling and corrosion of stainless steel tubes in the heat exchangers in nuclear reactors at the Savannah River Plant have caused decreased heat transfer efficiency and reduced operational life. This report addresses the microbiology and chemistry of the films present on these tubes, and the relation of this data to the corrosion of the tube material (304L stainless steel). Very few microorganisms other than bacteria were found in the biofilm. Bacteria capable of producing H_2S, organic acids, anaerobic conditions, and slime have all been isolated from these films. All of these have been implicated in corrosion processes. The most remarkable chemical finding was the inability to detect chloride in the film around areas of presumed chloride induced stress corrosion cracking. Three model systems were used to test the fouling and corrosion potential of metal specimens under a variety of environmental conditions including various biocide regimes. Using these systems, potential improvements in the use of chlorine as a biocidal agent have been observed. It was also shown that larger bacterial populations (including viable and killed cells) were associated with corroded areas as compared to noncorroded areas on the same specimen.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 55736, 55760, 55761, 55763, 56464

55776 **(BNL-NUREG—33664) BNL severe-accident sequence experiments and analysis program.** Greene, G.A.; Ginsberg, T.; Tutu, N.K. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 2p. (CONF-8310143—2). NTIS, PC A02/MF A10 - GPO. Order Number DE83017944.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

In the analysis of degraded core accidents, the two major sources of pressure loading on light water reactor containments are: steam generation from core debris-water thermal interactions; and molten core-concrete interactions. Experiments are in progress at BNL in support of analytical model development related to aspects of the above containment loading mechanisms. The work supports development and evaluation of the CORCON (Muir, 1981) and MARCH (Wooton, 1980) computer codes. Progress in the two programs is described.

55777 (CONF-8210168—, pp 153-170) **Basic issues of nuclear safety.** Moore, J.S. (Westinghouse Electric Corp., Pittsburgh, PA). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The nuclear power industry has an excellent safety record in relation to its benefits and to the risks of other technologies, but there is a limit and a cost when society tries to achieve zero risks from radiation sources. Nuclear facilities are designed and engineered with redundant and reliable systems to keep fuels cooled and to separate radiation sources from the public. Safety design includes emergency coolant and barrier systems to deal with an emergency. Changes in training and safety analysis came about after the Three Mile Island accident. Public concern also focuses on safety issues of waste disposal and on corrosion and vibration damage to reactor vessels. Public fear and misunderstanding are a reflection of the newness of nuclear technology. 4 figures. (DCK)

55778 (CONF-8210168—, pp 171-180) **Risks of nuclear power.** MacKenzie, J.J. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Focusing on nuclear-power-plant safety and unreliability problems, the author describes the poor performance and quality-control record and criticizes the risk assessments prepared by nuclear promoters. Federal insurance subsidies, through the Price-Anderson Act and the arbitrary liability ceiling, have permitted the industry to build plants, but the aftermath of Three Mile Island shows that nuclear plants are still uneconomical for utilities and investors. (DCK)

55779 (CONF-8210168—, pp 181-182) **Nuclear power: opportunities and constraints.** Reed, C. (Commonwealth Edison, Zion, IL). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The experience of Commonwealth Edison illustrates the opportunities and constraints of nuclear power from the utility point of view. Nuclear power has a 25-year cost advantage over coal plants of 21 to 38%, as well as a better safety and reliability record. Escalating regulations and declining public confidence, however, are two major constraints. The new Institute of Nuclear Power Operators (INPO) can help to counteract this by improving plant performance and compliance with safety regulations. (DCK)

55780 (CONF-8210168—, pp 183-186) **Are nuclear power plants safe.** Shewmon, P.G. (Ohio State Univ., Columbus). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Nearby residents may be safer from any physical harm caused by nuclear reactors than stockholders whose money is at risk when a serious accident occurs. Steam-generator degradation and leaks and the pressurized thermal shock to pressure vessels are two potential problems requiring a sequence of unlikely events. Utilities can reduce the risks with further research and improved design. (DCK)

55781 (CONF-8210168—, pp 187-190) **Illinois' nuclear-preparedness program.** Jones, E.E. (Illinois Energy Disaster Services Agency, Springfield). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The Illinois Emergency Services and Disaster Agency (ESDA) will coordinate all state agencies if an accident should occur at a nuclear power facility. The ESDA operates under the Illinois Plan for Radiological Accidents (IPRA). An overview of the IPRA and the results of federally mandated exercise drills demonstrate that Illinois is serious about having a workable, as well as a good, paper plan. (DCK)

55782 **(INIS-mf—8442(Vol.1-13)) Sizewell 'B' PWR pre-construction safety report.** (Central Electricity Generating Board, London (UK)). 1982. 4551p. NTIS (US Sales Only), PC A99/MF A01. Order Number DE83703492.

The Pre-Construction Safety Report (PCSR) for a PWR power station to be constructed as Sizewell 'B' is presented in 13 volumes containing 16 chapters. The PCSR has been submitted to the Nuclear Installations Inspectorate in support of the Central Electricity Generating Board's application for consent to the extension at Sizewell. It describes the design and provides the safety case for the proposed station, which comprises a 4-loop pressurized water reactor with associated generating plant and supporting auxiliary equipment. A general description of the station and its site is given. The strategy for ensuring nuclear safety is set out and the general design aspects of systems and plant outlined. The plant and systems, including their safety design bases and the fault analyses carried out for the design are described. Finally the way in which the plant will be decommissioned at the end of its useful life is outlined.

55783 (INIS-mf—8476, pp vp) **Application of diagnostic methods to primary circuit components of WWER type nuclear power plants.** Jaros, I. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). [nd]. (In Slovak). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.1).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

A semiautomatic diagnostic system is described as installed in unit 2 of the V-1 nuclear power plant. The method is discussed of processing diagnostic tests, and preliminary results are given of the experimental research into the diagnostic system response to mechanical impacts onto the pressure vessel inner wall. The results are also given of the frequency analysis of the main circulating pump of the primary coolant circuit of the V-1 nuclear power plant unit 1. (J.B.).

55784 (INIS-mf—8477, pp vp) **Measuring system for in-service inspections of nuclear reactors.** Skala, Z. (Skoda, Plzen (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A10/MF A01. (CONF-8105221—).

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

During regular in-service inspections the state of reactor internals is checked and faults in material detected. Visual checks are made for surface inspection, usually remote-controlled using closed circuit television. In order to check the whole volume of the material the ultrasonic pulse echo method is used, controlled manually and automatically. Data collection and processing is carried out using the IDA microcomputer which controls the operation of the control unit, communicates with the system of manipulator drive control, the peripherals, the external computer and the operator. Following completion of measurements the data are processed in detail using a digital computer which arranges the data according to the failures which they concern, displays the location of the defects and evaluates the quality of the tested component. (M.D.).

55785 (INIS-mf—8478, pp 21) **Mobile leak testing system.** Ungr, F. [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8105221—Suppl.).

From National seminar on mobile measuring systems - MOMES 81; Manetin, Czechoslovakia (12 May 1981).

The design and implementation are described of a mobile testing unit ULTRATEST M for helium leak tests. The equipment has been developed by Leybold-Heraeus GmbH in Cologne and is in-built in a Mercedes-Benz 208 van. The equipment is designed for the operative use in assembly and construction of nuclear power plants and its throughput is sufficient for checking the whole upper reactor block. It may also be used for removing defects of vacuum equipment requiring a high level of tightness or equally demanding equipment used in the chemical industry. Experience with the equipment is described. (B.S.).

55786 **(INIS-mf—8484) PWR pressure vessel integrity. UKAEA: video recorded talks.** (UKAEA Headquarters, London). 1983. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703494.

The subject is discussed as follows: significance of integrity in relation to probability of other reactor accidents; lessons of experience (statistics of failure of conventional pressure vessels); influence of operation conditions; influence of design construction and operation (materials, methods of fabrication); importance of standards; a lifetime's changes (failure probability changes to be expected during 40 years). Some information about reactor pressure vessel for the projected Sizewell B plant is appended. (U.K.).

55787 **(INIS-mf—8487) How safe is nuclear power.** (UKAEA Headquarters, London). Feb 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703488.

The subject is discussed, with particular reference to nuclear power in the UK, as follows: ionising radiations; components of the radiation dose to which on average each person in the UK is exposed; regulation and control; mining; reactor operations - accidents, safety; transport of spent fuel; radioactive wastes; fast reactors and plutonium; insurance.

55788 **(Juel-Spez—172) Investigations on reactivity accidents with the HTR-module.** Mertens, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Sep 1982. 17p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750997.

Using the axially one-dimensional short-time dynamics program DYNOTTO, power transients and temperature transients of low-power pebble-bed HTR (HTR-Module) in reactivity accidents within the first half hour have been investigated. Even in case of accidents such as the uncontrolled withdrawal of all control rods, assuming complete failure of the shut-down mechanism it is shown that especially low-power HTR are highly inherently safe. Fuel temperatures remain below 1,200°C and during the further history of the accident, largely determined by after-heat development, no critical values could be detected.

55789 **(NUREG—0852-Suppl.2) Safety-evaluation report related to the final design of the Standard Nuclear Steam Supply Reference System, CESSAR System 80 (Docket No. STN 50-470).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1983. 165p. NTIS, PC A08/MF A01 - GPO $6.00. Order Number DE84900069.

Portions are illegible in microfiche products.

Information is presented concerning reactor components; core thermal-hydraulics; RHR system; containment spray system; reactor instrumentation; reactor accidents; and LOCA thermal-hydraulics.

55790 **(NUREG—1022) Licensee Event Report system: description of system and guidelines for reporting.** Hebdon, F.J. (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Sep 1983. 89p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84900039.

On July 26, 1983, the Commission published in the Federal Register a final rule (10 CFR 50.73) that modifies and codifies the Licensee Event Report (LER) system. The rule becomes effective on January 1, 1984. This NUREG provides supporting information and guidance that will be of interest to persons responsible for the preparation and review of LERs. The information contained in this NUREG includes: (1) a brief description of how LERs are analyzed by the NRC; (2) a restatement of the guidance contained in the Statement of Consideration that accompanied the publication of the LER rule; (3) a set of examples of potentially reportable events with staff comments on the actual reportability of each event; (4) guidance on how to prepare an LER, including the LER forms; and (5) guidance on submittal of LERs.

55791 (NUREG/CP—0043, pp 1-30) **Basic scaling principles adopted for simulation of BWR behaviour during small LOCAs.** D'Auria, F.; Mazzini, M.; Vigni, P. (Univ. of Pisa, Italy). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

This paper refers to the activities carried out for the design of PIPER ONE experimental apparatus to investigate thermalhydraulic behavior of BWRs during small LOCAs. The applicability of scaling laws to two-phase flow phenomena is discussed and the scaling criteria adopted for the definition of the experimental facility are presented. To this respect, the natural circulation has been chosen as the main aspect to be simulated, after it has been pointed out that all the phenomena arising in a real plant cannot be reproduced all together. After a brief description of the calculations carried out by RELAP 4/Mod. 6 code in order to compare the evolution of two accidents in the reference plant and in the PIPER ONE apparatus, some conclusions about the scaling principles to be adopted for the simulation of small LOCA in LWRs are drawn.

55792 (NUREG/CP—0043, pp 31-61) **Scaling basis for BWR safety experiments.** Sutherland, W.A.; Allison, S.A. (General Electric Co., San Jose, CA). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

A brief overview of the governing phenomena in BWR Safety testing is presented to set the basis for determining the physical parameters that require consideration in scaling, and a review is made of the inherent BWR system features that make possible scaled experimental evaluations of reactor response. Because the core is an assembly of individual fuel bundles, each enclosed in a channel, full-scale testing can be achieved over a wide range of conditions using full-sized, full length bundles. By imposing thermal hydraulic boundary conditions across prototypical full-size fuel bundles, many scaling compromises can be avoided. Full height integral system facilities and components are utilized where practical to further enhance system simulation. The implications of any remaining scaling compromises on system response are evaluated through comparative studies of the experimental facility and the full-size BWR using the best estimate code TRAC-BWR.

55793 (NUREG/CP—0043, pp 63-94) **Scaling of BWR parallel channel effects.** Conlon, W.M.; Lahey, R.T. Jr. (Rensselaer Polytechnic Inst., Troy, NY). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

An effective emergency core cooling system (ECCS) is necessary to prevent fuel damage and radioactivity releases in the event of a loss of primary coolant in a nuclear reactor. The authors have conducted an experimental study of the influence of the countercurrent flow limitation (CCFL) and parallel channel effects (PCE) on the distribution of emergency core spray cooling water in a Boiling Water Nuclear Reactor (BWR) following a postulated design loss-of-coolant accident (LOCA). In particular, a series of experiments was performed in a scaled test section to investigate the potential for BWR steam binding. This paper describes the background, scaling bases, and significant findings of these experiments.

55794 (NUREG/CP—0043, pp 95-107) **Influence of scaling of the Battelle BWR test facility on the analysis of experimental results.** Wahba, A.B.; Wolfert, K. (Gesellschaft fuer Reaktorsicherheit, Garching, Germany). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

A steam line break test was performed at the Battelle blowdown test facility in Frankfurt, West Germany, to study the effects of scaling on experimental results. The test facility is a scaled (1:82) version of a boiling water reactor (BWR). Electric power available to the ore simulator was limited to about 0.66 MW instead of the 28 MW needed for an accurately scaled simulation. Core mass flow was very low compared to that in a commercial BWR, and phase separation dominated. During the initial phase of the blowdown, marked pressure differences were measured across the core barrel. Analysis of the Dl-3 test with the GRS code DRUFAN-02 indicated that the pressure difference across the core barrel is strongly dependent on the model used for two-phase flow in the flow paths inside the pressure vessel. The homogeneous model underestimated pressure differences in both amplitude and duration. Accurate pressure difference calculations were possible only by using the drift-flux model in all pressure vessel flow paths. Thermal nonequilibrium phenomena were also predicted by DRUFAN-02.

55795 (NUREG/CP—0043, pp 109-141) **Scaling of thermally driven fluid mixing and heat transfer associated with pressurized thermal shock of reactor vessels.** Rothe, P.H.; Wallis, G.B. Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

During certain calculated reactor transients including small break loss of coolant accidents, very cold coolant water (40°F) is injected into the cold legs at high pressure. Under these circumstances, the reactor vessel is thermally stressed and the continuing integrity of the vessel must be evaluated. In general terms, this is a multi-disciplinary problem in the areas of nuclear, structural, heat transfer and fluids engineering. This paper presents analytical and empirical evaluations of the scaling of the heat transfer and fluid dynamic aspects of the problem.

55796 (NUREG/CP—0043, pp 235-251) **Scaling considerations for FLECHT-SEASET.** Hochreiter, L.E.; Rosal, E.R.; Tome, A. Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

The NRC/EPRI/W FLECHT-SEASET systems effects test facility was originally designed to study low pressure reflood PWR systems behavior. The facility was modified to also study single-phase, two-phase, and reflux condensation natural circulation transients which are more typical of a high pressure PWR small break LOCA or operational transient. The question of how to design the scaled facility to study each of these diverse conditions had to be addressed. The traditional scaling approaches such as linear, power to volume, volumetric, and dimensionless numbers, were examined and evaluated for each test before power to volume was selected. The thermal-hydraulic phenomena for each type of test was reviewed and the primary driving forces for each test identified and preserved. Since the pressure which was to be simulated in the two experiments was significantly different, two-phase flow scaling approaches were examined, particularly for the reflux condensation natural circulation tests. The paper will describe the scaling basis chosen for each test series and will highlight where the scaling compromises were and how they were technically resolved.

55797 (NUREG/CP—0043, pp 253-275) **Scaling considerations for reduced-scale modeling of steam generators: the Westinghouse Model Boiler 2 test facility.** Rod, S.R.; Hopkins, G.W.; Mendler, O.J. (Westinghouse Electric Corp., Pittsburgh, PA). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

Verification of the performance of steam generators and of computer codes used to predict performance has been conducted on integrated systems which include all the features of commercial units. Since testing of a full-size (~ 850 MWt) steam generator is often impractical, reduced-scale models, which provide greater flexibility in operating parameters, are employed. The scale model must retain the essential physical features and performance characteristics of the prototype. This report outlines the fundamental physical principles and the more judgemental factors underlying the original design of the Westinghouse Model Boiler 2 test facility for steady-state experiments and its proposed modification to suit the different requirements of transient tests.

55798 (NUREG/CP—0043, pp 319-352) **Condensation effects in large scale BWR safety experiments.** Sutherland, W.A. (General Electric Co., San Jose, CA). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

Experiments addressing thermal hydraulic phenomena under Loss-of-Coolant-Accident (LOCA) conditions have been conducted in a full scale 30 degree sector mock-up of the Boiling Water Reactor (BWR). The test program included both steady pressure and transient LOCA simulation, at system pressure up to ten atmospheres, and covered both specific thermal hydraulic phenomena and system response under blowdown/refill/reflood performance. Two condensation effects observed in these experiments contributed to the effective system refill/reflood performance. Two condensation effects of particular interest are core spray injection leading to localized subcooling in the upper plenum that breaks down counter-current flow limiting at the top of the core, and low pressure coolant injection leading to subcooling in the lower plenum that reduces liquid flow out the jet pumps. Both of these effects augment plenum refill and core reflood. Other condensing effects identified and evaluated are evidenced by the coupling of upper plenum two-phase level with core spray injection location, and the periodic flooding and voiding of the guide tube region. Condensation effects do not lead to system performance instability or oscillation, and the phenomena are satisfactorily modeled by system analysis methods.

55799 (NUREG/CP—0043, pp 477-492) **Reentrainment of droplet from grid spacer in mist flow portion of LOCA reflood of PWR.** Lee, S.L.; Cho, S.K.; Sheen, H.J. (State Univ. of New York, Stony Brook). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

An investigation is made on the influence of a quenched grid spacer on the greatly enhanced heat transfer from heated fuel rods during the mist flow phase of emergency reflood of loss of coolant accident (LOCA) of a pressurized water reactor (PWR). The situation for the case of a dry grid spacer before its quenching has not been covered in this study. The experimental technique used is a relatively simple optical scheme which combines the reference-mode laser-Doppler anemometry making use of the scattering of a light beam from a droplet. The results reveal that the large droplets in the mist flow, which are intercepted by the grid spacer, are responsible for the creation of a large number of smaller droplets. These small droplets, due to their large surface area to mass ratios, can serve as superb evaporative cooling agents to heat transfer downstream of the grid spacer.

55800 (NUREG/CP—0043, pp 493-510) **Hydraulics of blocked rod bundles.** Yao, S.C. (Carnegie Mellon Univ., Pittsburgh, Pa); Loftus, M.J.; Hochreiter, L.E. Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

The hydraulic results of a series of 21-rod bundle water experiments have been analyzed systematically. Models are established for the prediction of the pressure drop over unblocked bundles, grid spacers, coplanar concentric blockage, coplanar concentric blockage with bypass, non-coplanar concentric blockage, and non-coplanar non-concentric blockage. The models can be extended to other bundles of similar conditions. The comparisons of these models with the experimental results agree reasonably.

55801 (NUREG/CP—0043, pp 511-545) **Flow blockage heat transfer in the FLECHT-SEASET 21-Rod Bundle tests.** Loftus, M.J.; Hochreiter, L.E. (Westinghouse Electric Corp., Pittsburgh, PA). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

A series of single phase steam cooling and two-phase forced and gravity reflood experiments have been conducted in the NRC/EPRI/W FLECHT-SEASET 21-Rod Bundle Program. The objective of these experiments is to examine the local heat transfer effects of rod bundle blockages in single and two-phase flow. The question to be answered in whether the local heat transfer effects are significantly different in blocked bundle rod arrays as compared to an unblocked reference bundle at the same conditions. Various combinations of blockage shapes and axial blockage distributions have been examined in the 21-rod bundle program which are unique to this program. Detailed rod temperature and vapor temperature measurements were made to assess the local heat transfer effects of the blockages relative to an unblocked reference test. Both single phase and two-phase forced reflood heat transfer results are shown.

55802 (NUREG/CP—0043, pp 547-581) **Study of two-phase flow thermal-hydraulics during bottom reflooding of nuclear reactor cores.** Ghiaasiaan, S.M.; Catton, I.; Duffey, R.B. (Univ. of California, Los Angeles). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

Based on experimental observation of two-phase flow void fraction behavior during reflooding, and empirical correlation is proposed for fitting reflooding two-phase void fraction distribution. The empirical void fraction distribution is used to correct Hsu's transition boiling correlation for the effect of local void fraction. The UCLA Multi-Channel Reflood Model for analysis of reflooding thermal hydraulics is reviewed. Simple methods proposed for treatment of two-phase phenomena and core multi-dimensional effects are shown to be adequate. The model predictions are shown to be adequate. The model predictions are shown to compare well with experiment.

55803 (NUREG/CP—0043, pp 583-613) **PWR downcomer fluid temperature transients due to high pressure injection at stagnated loop flow.** Theofanous, T.G.; Nourbakhsh, H.P. (Purdue Univ., West Lafayette, IN). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

A simple, phenomena-oriented approach for the prediction of overcooling due to High Pressure Injection at zero loop flow is proposed. With the help of graphical representations for the decay of buoyant jets the prediction of the complete space-time temperature variations is reduced to simple hand calculations. Scaling aspects important in achieving adequate laboratory simulations of the reactor system are discussed.

55804 (NUREG/CP—0043, pp 617-656) **Method of scaling limiting processes and phenomena in single and two phase systems.** Zuber, N. Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

The objective of the paper is to show that the catastrophe theory (CT) and kinematic wave (KW) model provide a natural and unifying framework for modeling and scaling critical phenomena and limiting operating conditions in single and two phase flow systems. In particular, the CT/KW method provides scaling groups/functions and stability criteria/maps for: 1P and 2P flow regime transition; CCFL; hydraulic instability; and thermal instabilities.

55805 (NUREG/CR—2970-Vol.3) **Materials Science Division light-water-reactor safety research program. Quarterly progress report, July-September 1982.** Shack, W.J.; Rest, J.; Kassner, T.F.; Neimark, L.A.; Chung, H.M.; Claytor, T.N.; Kupperman, D.S.; Maiya, P.S.; Nichols, F.A.; Park, J.Y. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 64p. (ANL—82-41-Vol.3). NTIS, PC A04/MF A01 - GPO. Order Number DE84000183.

This progress report summarizes the Argonne National Laboratory work performed during July, August, and September 1982 on water reactor safety problems. The research and development areas covered are Environmentally Assisted Cracking in Light Water Reactors, Transient Fuel Response and Fission Product Release, Clad Properties for Code Verification, Posttest Fuel Examination of the ORNL Fission Product Release Tests, and Examination of TMI-2 Fuel Specimens.

55806 **(NUREG/CR—3277) RELAP5 assessment: semiscale Mod-3 small-break tests.** Summers, R.M. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1983. Contract AC04-76DP00789. 201p. (SAND—83-1038). NTIS, PC E08/MF A01 - GPO. Order Number DE84000175.

Includes 1 sheet of 48x reduction microfiche.

The RELAP5 independent assessment project at Sandia National Laboratories is part of an overall effort funded by the NRC to determine the ability of various systems codes to predict the detailed thermal-hydraulic response of LWR's during accident and off-normal conditions. The RELAP5/MOD1 code is being assessed at SNLA against test data from various integral and separate effects test facilities. As part of this assessment matrix, a series of small break experiments performed at the Semiscale Mod-3 facility have been analyzed. The results show that RELAP5/MOD1 will predict reasonably well many aspects of the four small break transients analyzed. Many problems were encountered in matching the initial primary and secondary steady state conditions, which in turn affected the transient calculations. Although the calculations predicted the relative severity of the experiments in terms of mass inventories and distribution, quantitatively they generally predicted a more severe transient than was observed experimentally.

55807 **(NUREG/CR—3437) Data analysis using the Binomial Failure Rate common cause model.** Atwood, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1983. Contract AC07-76ID01570. 28p. (EGG—2271). NTIS, PC A03/MF A01 - GPO. Order Number DE84000488.

This report explains how to use the Binomial Failure Rate (BFR) method to estimate common cause failure rates. The entire method is described, beginning with the conceptual model, and covering practical issues of data preparation, treatment of variation in the failure rates, Bayesian estimation of the quantities of interest, checking the model assumptions for lack of fit to the data, and the ultimate application of the answers.

55808 **(NUREG/CR—3475) Critical discharge of initially subcooled water through slits.** Amos, C.N.; Schrock, V.E. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 293p. (LBL—16363). NTIS, PC A13/MF A01 - GPO $7.00. Order Number DE84000444.

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This report describes an experimental investigation into the critical flow of initially subcooled water through rectangular slits. The study of such flows is relevant to the prediction of leak flow rates from cracks in piping, or pressure vessels, which contain sufficient enthalpy that vaporization will occur if they are allowed to expand to the ambient pressure. Two new analytical models, which allow for the generation of a metastable liquid phase, are developed. Experimental results are compared with the predictions of both these new models and with a Fanno Homogeneous Equilibrium Model.

55809 **Fault tree analysis using modular logic models.** Varnado, G.B. (Sandia National Lab., Albuquerque, NM); Horton, W.; Lobner, P. pp 568-576 of Probabilistic risk assessment. La Grange Park, IL; American Nuclear Society, Inc. (1982). (CONF-810905—).

From ANS/ENS topical meeting on probabilistic risk assessment; Port Chester, NY, USA (20 Sep 1981).

Nuclear power plants have many features in common. The functions and configuration of safety systems, and the types of components used in the systems are similar for different plants. We developed modular logic models to represent the fundamental fault logic for many commonly occurring nuclear power plant features. We further defined procedures to guide the fault tree analyst through the process of altering and connecting appropriate modular logic models to build detailed fault trees for specific systems. An interactive computer system is used to assemble and alter the modular logic models. This paper discusses the modular logic approach to fault tree analysis and describes the tools currently available to support the approach.

55810 **Comparison of transient-heating burst test results of unirradiated and irradiated Zircaloy-4 fuel rod cladding.** Lowry, L.M. (Battelle Columbus Labs., OH); Perrin, J.S. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 749-764(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The Nuclear Regulatory Commission supported an experimental program to study the mechanical properties of both unirradiated and irradiated fuel rod cladding. The program was designed to produce a mechanical property data base for use in developing modeling codes which could then be used to predict the performance of Zircaloy-4 clad fuel rods under various reactor loss-of-coolant accident (LOCA) conditions. Transient-heating burst tests were conducted at Argonne, Battelle Columbus, and ORNL. A brief description of the testing methods, specimens, equipment, and procedures illustrates the similarities and differences in tests conducted at each laboratory. The data obtained from tests conducted in steam and utilizing test specimens with internal heaters or specimens containing alumina mandrels or pellets were compared for heating rates of 5, 28, and 55 C/sec. Both burst pressure and circumferential failure strain data versus burst temperature were plotted and compared in the range of 650 to 1250°C. It was found that testing methods, specimen oxidation layer, and irradiation affected the transient-heating burst test data.

55811 **Natural convection in closed vertical cylinders with particular reference to gas cooled reactor standpipes.** Spence, I.D. Rugby, England; Lanchester Polytechnic (1975). 279p. British Library, Boston Spa, Wetherby, West Yorks. No. D37628/81.

Thesis.

The access to the core for fuel assemblies and control rods of the Advanced Gas Cooled Reactor is through the top cap by means of standpipes. The standpipe is essentially a cylindrical, vertical tube with cooled side wall, closed upper end and an orifice at the lower end which is exposed to the hot core fluid. This creates confined natural convection flow in the empty standpipe and this is the subject of this thesis. The investigation is carried out using analytical and experimental methods. For the analytical work, solution of laminar and turbulent flow is attempted using finite-difference computer techniques. The laminar flow performance is evaluated using two different finite-difference procedures, and the results are compared to each other and to existing analytical and experimental results for the open thermosyphon with cool inflow and hot sidewall, i.e. the complementary problem to the present one. For turbulent flow a two equation turbulence model is employed which provides transport equations for the kinetic energy of turbulence and its dissipation rate. The experimental rig is a full scale replica of the Advanced Gas Cooled Reactor control rod mechanism standpipe. Carbon dioxide and helium are used as the working fluids for the series of tests.

25 ENERGY STORAGE

55812 **(CONF-830974—Summ.) Project summaries of the DOE physical and chemical energy storage annual contractors' review meeting.** (MCC Associates, Silver Spring, MD (USA); Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 58p. NTIS, PC A04/MF A01. Order Number DE83017802.

From Physical and chemical energy storage annual contractors' review meeting; Arlington, VA, USA (12 Sep 1983).

Fifty-three physical and chemical energy storage projects are briefly summarized, including the goals, objectives, status, and funding of each. (LEW)

55813 **(DOE/ET/26940—T3) Research and development related to energy-storage systems, Task II. Final report.** Beckmann, R.B. (Maryland Univ., College Park (USA)). 1979. Contract AS05-77ET26940. 193p. NTIS, PC A09/MF A01. Order Number DE83018190.

After a brief review of foreign research and development efforts in energy storage, various organizations are listed that were

contacted to seek information relating to possible resource persons working in the area. A compendium of the literature search results covering energy storage research and development in 24 countries is provided. These countries are: Australia, Austria, Belgium, Brazil, Canada, Czechoslovakia, Denmark, Finland, France, Federal Republic of Germany, Great Britain, Greece, Ireland, Israel, Italy, Japan, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Taiwan, and Russia. (LEW)

55814 **(DOE/ET/26940—T4) Review of National Techno-Economic Energy models with particular reference to the evaluation of energy-storage considerations.** Widhelm, W.B.; Doyle, T.H. (Maryland Univ., College Park (USA)). 24 Jan 1979. Contract AS05-77ET26940. 57p. NTIS, PC A04/MF A01. Order Number DE83018191.

This preliminary screening of NTEE models indicates that some of these models can reasonably be used in evaluating energy storage considerations. Specifically, the SRI-Gulf models of LLL and DOE, the Brookhaven models, ETA-MACRO and PILOT appear as likely candidates. The next step necessary is to (1) ascertain specifically what energy storage considerations are of interest and their attendant data bases, and (2) to then discuss injection of these considerations into the various models with the modelers themselves. In this way, feasibility, developmental time and costs, and operational turn-around and costs can be reasonably compared and evaluated for actual implementation.

2501 Magnetic

55815 **(DOE/ET/26602—35-Rev.) Superconductive energy storage. Volume IV. Final technical report revision, January 1976-September 1981.** Hartwig, K.T. Jr. (ed.). (Wisconsin Univ., Madison (USA). Applied Superconductivity Labs.). Jul 1983. Contract AC02-76ET26602. 895p. NTIS, PC A99/MF A01. Order Number DE84001383.

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The design history of Inductor-Converter (I-C) superconductive energy storage units includes first a solenoid in one deep tunnel, then segmented deep solenoids and finally a fifteen tunnel hour-glass system. Conductor research includes NbTi studies, welding of high purity and high strength aluminum components, moderate strength aluminum alloy development, conductor cruciform alloys and overall conductor fabrication studies. Cryogenic tests of boundary layers are undertaken. Structure research includes the analytical structural design of the conductor, the rippled dewar system and the fiberglass composite struts. Experimental structural work includes property tests of fiberglass composites emphasizing polyester products. The tests are for compressive strengths, cyclic compression, shear strength, fracture toughness, bonding, tensile strength, and creep. Rock mechanics research includes experimental site studies of granite, quartzite, rhyolite, and sedimentary locations. Topics include in situ and laboratory measurements of rock stresses, ground water characteristics, joints, and basic rock sample properties. Design studies cover a three tunnel model, a five tunnel model and a low aspect ratio system. Some attention is given to earth quake analysis. This cryogenics effort includes refrigeration design, cool-down analysis, conductor cooling comparisons, heat transfer from bedrock, and conductor stability. Experimentally there are several He II heat transfer and transport experiments, a He I two phase flow void fraction study, and dielectric breakdown in helium. The electric studies cover converter-inverter technology with both analytical and experimental circuitry. System design and electrical use for diurnal storage and pulsed storage cover primarily three phase Graetz bridge circuitry with some attention to a flying capacitor system.

2508 Chemical

REFER ALSO TO CITATION(S) 55564, 55611

2509 Batteries

REFER ALSO TO CITATION(S) 55944, 55945

55816 **(AD-A—129299/4) Investigation of lithium thionyl chloride battery safety hazards. Quarterly technical progress report 29 Sep-31 Dec 81.** McDonald, R.C. (GTE Communications Products Corp., Waltham, MA (USA). Power Systems Operation). 31 Dec 1981. 62p. NTIS, PC A04/MF A01.

Glass Li/SOCl2 cells have been designed and built which will be used to discharge and overdischarge flat electrodes in sufficient but not excess electrolyte. The cells will be used for generation of electrolyte samples for chemical spectroscopy and overdischarged cathodes for morphological studies. A metal cell has been designed and built for overdischarge of flat electrodes. E.S.R., Raman, FTIR, and UV/VIS fluorescence spectra have been taken of electrolyte at various stages of discharge and overdischarge. Two chemical species detectable with ESR are generated on discharge. The first resonance found also in electrolyte solutions saturated with sulfur, develops uniformly through discharge. The second as yet unidentified species becomes evident towards the second half of discharge increasing species becomes evident towards the second half of discharge increasing in concentration faster than sulfur. Following removal from the cell, the second species disappears as visible fluorescence increases in intensity the sulfur related peak remains. Raman and FTIR spectra show a profusion of emission and absorption peaks respectively. Analysis of this data is still in process. Preliminary optical studies of overdischarged cathode studies in cathode limited cells show that lithium dendrites do grow on the surface of carbon.

55817 **(AD-A—129300/0) Investigation of lithium thionyl chloride battery safety hazards. Quarterly technical progress report 1 Jan-31 Mar 82.** McDonald, R.C. (GTE Communications Products Corp., Waltham, MA (USA). Power Systems Operation). 31 Mar 1982. 43p. NTIS, PC A03/MF A01.

Scanning electron and optical microscopic investigation of an overdischarged cathode from a cathode limited Li/SOCl2 cell reveal a three-dimensional reticulated lithium dendrite structure. Individual dendrites do not grow and longer than about 50 microns or any thicker than about 4 microns in diameter before branching at random angles. E.S.R. spectra of 50% and 100% overdischarged anode limited cells reveal a third chemical species carrying an unpaired electron which is distinct from the two radical species observed during discharge. No significant difference is observed between the Raman spectra of 100% discharged electrolyte and 50% cathode limited overdischarged electrolyte. The same holds true for infrared spectra. The Raman spectra of 90% anode limited overdischarged electrolyte shows most of the peaks occuring at 100% discharge in addition to 687, 727, 819, and 854 per cm. The infrared spectrum of the same solution shows most the the features occuring at 100% discharge in addition to the reduction of 981 cm-1 and growth of peaks at 1397,1085,1070 (shoulder) 661 and 602 cm-1. Peaks at 1070 and 661 always occur weakly in discharged electrolyte spectra and are quite strong in the spectrum of Li_2SO_4 saturated electrolyte.

55818 **(AD-A—129301/8) Investigation of lithium thionyl chloride battery safety hazards. Quarterly technical progress report 1 Apr 82-30 Jun 82.** McDonald, R.C. (GTE Communications Products Corp., Waltham, MA (USA). Power Systems Operation). 30 Jun 1982. 40p. NTIS, PC A03/MF A01.

Storage of discharged electrolyte in AgCl cells for infrared analysis leads to artifactual absorbances. However, there are real changes in discharge and overcharge intermediates as shown by changes in infrared spectra of electrolyte stored in glass. Debye-Scherrer examination of cathodes overdischarged in cathode limited

cells indicates the presence of both LiCl and LI_2O_2 as well as at least one other solid.

55819 (AD-A—129302/6) Investigation of lithium thionyl chloride battery safety hazards. Final technical report Sep 81-Nov 82. McDonald, R.C.; Dampier, F.W.; Wang, P.; Bennett, J.M. (GTE Communications Products Corp., Waltham, MA (USA). Power Systems Operation). Jan 1983. 85p. NTIS, PC A05/MF A01.

The chemistry of discharge and overdischarge in $Li/SOCl_2$ cells has been examined with Raman emission, Fourier transform infrared, and electron spin resonance spectroscopies to determine if any hazardous reactions can occur. Under moderate discharge rate at room temperature, the electrolyte from discharged and cathode limited overdischarged cells contains primarily $LiAlCl_4.3\ SO_2$, LiAlCl2 $SOCl_2$, and perhaps $LiAlCl_4.SOCl_2.SO_2$; traces of SO_3 are indicated. Three free radicals are present at low concentrations on discharge and cathode limited overdischarged with two additional radicals appearing on extended anode limited overdischarge. At least one of these is cationic polymeric sulfur. Both FTIR and ESR suggest intermediates exist with lifetimes on the order of days from discharge and overcharge. No hazardous reactions were observed at anytime. Pressure from SO_2, a principal result of discharge, remains low due to the $LiAlCl_4.3\ SO_2$, complex in solution. Scanning electron and optical microscopic investigations lithium dendrite structure. Individual dendrites do not grow any longer than about 50 microns or any thicker that about four microns in diameter before branching at random angles. The extent of dendritic growth and the fate of the dentrites depends on the discharge conditions. No overcharged hazards were encountered in this study though several hazard scenarios suggested themselves.

55820 (ANL/ES—129) Health and environmental effects document for batteries - 1982: the lead/acid and zinc/halogen batteries. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 208p. NTIS, PC A10/MF A01. Order Number DE84000964.

This Health and Environmental Effects Document (HEED) is an assessment of the environmental health effects associated with production of lead/acid and zinc/halogen (zinc/chlorine and zinc/bromine) batteries for electric vehicle and utility load-leveling applications. Emissions are estimated for those industries required for production, use, and recycling of batteries, starting with mining and milling of raw materials. Emissions concentrations are estimated in the near field and in the far field for two chosen sites for each required industry. Human health risks associated with exposure to emissions are evaluated using dose-response models for lead, cadmium, and sulfur oxides. Health risks are estimated per industrial site; additional estimates are presented based on a scenario of 20,000 MWh/yr battery production. Comparisons are made of health risks associated with (1) near-field vs. far-field dispersion of emissions, and (2) lead/acid vs. zinc/halogen battery production. Solid and liquid waste disposal and an ingestion route for lead are addressed. Potential health risks of chlorine exposure from accidents involving electric vehicles powered by zinc/chlorine batteries are evaluated.

55821 Chemical colouration of sodium beta-aluminas. De Jonghe, L.C.; Buechele, A. (Lawrence Berkeley Lab., CA). *Journal of Materials Science;* **17**: 885-892(1982). Contract W-7405-ENG-48.

A variety of experiments was performed on Na β-alumina single crystals and Na β''-alumina polycrystals of different microstructures, to clarify the nature of chemical colouration produced by contact with sodium. It was found that the colouration is due to a reduction of the electrolyte by sodium, introducing oxygen vacancies compensated by electrons. Colouration and bleaching kinetics have been determined. It was found that in polycrystals colouration proceeds along the grain boundaries. Water has no effect. The role of the colouration in electrolyte degradation is discussed.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 56792

55822 (DOE/IG—0197) Drawdown reliability of the Bayou Choctaw Site of the Strategic Petroleum Reserve. (Department of Energy, Washington, DC (USA). Office of Inspector General). 28 Sep 1983. 26p. USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830.

The report describes improvements made in the management, technical, and operational aspects of the Bayou Choctaw Site. The inspection revealed that the Site has sufficient equipment capacity and reliability to satisfy the Phase I Drawdown Goals of 240 thousand barrels of oil per day. The Site cannot satisfy the Phase II and Phase III Drawdown Goals of 480 thousand barrels of oil per day in its present configuration. The SPR Project Office has projects underway to enable the Site to meet the Phase II and III Goals. Ways to further improve the ability of the Site to reliably meet the Phase II and III Goals are recommended. Comments from the Manager of the Oak Ridge Operations Office and the Manager of the SPR Project Office basically concur with our recommendations.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 55377, 55378, 55383, 55428, 55439, 55814, 55871, 55910

55823 (EUR—8459EN) EFOM 12C case studies. Littlechild, S.C.; Morris, J.L.; Vaidya, K.G. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 1983. 40p. Available from Commission of the European Communities.

The EFOM 12C model is used to assess the potential contribution of some new energy technologies. Cost and demand assumptions are reviewed and constraints on nuclear electricity capacity and assumptions on demand for energy and industrial output are modified to reflect recent revisions of energy projections. Choice of new technologies included in the model is based on an ETSU assessment. The technologies included are conservation, SNG, SNO, solar, FBR, pressurised fluidised bed Combustion, wave and wind power and CHP. The Reference Case shows that the total contribution of candidate technologies starts modestly in 1981 and rises to 10% of total primary energy in 2020. Sensitivity analyses show the effects on the energy sector of minimising import costs subject to upper limits on total cost and a nuclear moratorium. Wind power is insensitive to changes in assumptions while SNO and wave energy are highly sensitive.

55824 (NP—3902736) Organization of the petroleum exporting countries. Annual report, 1981. (Organization of the Petroleum Exporting Countries, Vienna (Austria). Public Information Dept.). 1981. 151p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83902736.

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OPEC's twenty-first year was typical of the vicissitudes of that chapter of the proverbial life of man - the trials and tribulations of adulthood and the seemingly limited occurrence of positive compensatory and advantageous events. As previously reported, the developments of the energy industry so far in the 1980s have been greatly influenced by long-term trends in energy consumption. These trends include the effects of substitution and conservation in energy use, as well as political and non-market influences on energy demand, such as IEA policies and the Gulf War. These factors of energy utilization carried on into 1981, and while they continued to pose challenges to OPEC's performance, all participants in the energy industry in general, and the oil market in particular, have come to regard the elements as those given in the analysis of the 1981 energy demand and supply balance. Similarly, while these issues remained in the industry during the year, no particular emphasis on those aspects of the development of the energy market will be made in this report. Rather, we shall lay emphasis on the short-term factors of the market environment.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 55721, 55869

55825 (CONF-8308113—2) Science in the context of ultimate reality and meaning. Gilbert, T.L. (Argonne National Lab., IL (USA)). 28 Jul 1983. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01. Order Number DE83017952.

From 2. biennial meeting of the Institute for Ultimate Reality and Meaning; Toronto, Canada (17 Aug 1983).

55826 (NP—3910799) Federal regulatory framework: effects on mineral exploration, and mine development on domestic public and private lands. (Whitney (John W.), Inc., Reno, NV (USA)). 1977. 54p. NTIS, PC A04/MF A01. Order Number DE83910799.

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This report evaluates the relationship between the federal regulatory environment as expressed by federal land management laws, federal environmental laws, and federal health and safety laws, and mineral exploration and mine development on federal and non-federal lands in the United States. Some of the background information required to prepare an assessment that examines constraints on non-federal minerals accessibility in the United States resulting fron federal laws, policies, and practices is included. The federal regulatory framework affects mineral exploration and mine development for locateable, leasable, and disposable minerals on both public and private lands. This paper identifies probable commodity effects, exploration effects, and mine development effects. This report focuses heavily on the effects of the regulatory framework on mining industry functions, especially at the mineral exploration stage. The regulatory framework is analyzed in three parts: the first describes the problem in terms of mineral demand, supply and the supply development process; the second describes the regulatory framework and its effects on mineral supply development by mineral commodity group as well as effects on mineral exploration and mine development; the third summarizes the findings and presents the conclusions drawn from those findings. 14 references, 5 figures, 11 tables.

55827 (OTA—3903086) Effects of federal laws, policies and practices on access to minerals on onshore, non-federal lands in North Carolina. Brown, H.S. (Geological Resources, Inc., Raleigh, NC (USA)). Sep 1977. 89p. NTIS, PC A05/MF A01. Order Number DE83903086.

As part of an investigation of the effects of federal laws, policies, and practices on access to minerals on onshore, non-federal lands. The investigation seeks to determine the need for and the potential effects of continuing, modifying and/or restructuring these federal laws, policies and practices. Because it has a variety of types of mineral resources and contains a variety of cultural and geographic areas typical of most of the eastern United States, North Carolina was selected as a representative study area. This paper summarizes results of that study. (ACR)

55828 (OTA—3910800) Transportation access across federal to non-federal land in Alaska for hardrock mineral development: policy alternatives and their impacts. (Harbridge House, Inc., Washington, DC (USA)). Feb 1978. 90p. NTIS, PC A05/MF A01. Order Number DE83910800.

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A range of alternatives which Congress could adopt to address the issue of transportation access across federal to non-federal lands in Alaska for the purpose of hardrock mineral development is defined, and impacts that could result from Congressional action analyzed. Impacts dealt with are institutional, economic, social, and environmental. (ACR)

55829 (OTA—3910804) Summary of federal practices adversely affecting minerals access on nonfederal lands. (Resource Planning Associates, Inc., Cambridge, MA (USA)). 5 Oct 1977. 36p. NTIS, PC A03/MF A01. Order Number DE83910804.

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As part of a study of how federal laws, policies, and practices affect access to minerals on non-federal lands, the specific federal practices adversely affecting minerals access on non-federal land was identified, and possible legislative or executive actions for alleviating these problems were suggested. (ACR)

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 55419, 55423, 55452, 55949

55830 (CONF-8210168—, pp 59-69) Acid rain: the path from research to public. Cowling, E.B. (North Carolina State Univ., Durham). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The author summarizes the present status of scientific knowledge on atmospheric deposition and its effects, and relates the knowledge accumulated to the processes of public decision making about energy use and environmental quality. A summary of the author's fuel status report and seven recommendations for further work appear in the appendix. 88 references, 3 figures.

55831 (CONF-8210168—, pp 93-102) New evidence on acid rain from elemental tracers. Rahn, K.A. (Univ. of Rhode Island, Kingston). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Evidence from the tracking of long-range air-pollution movement shows that groups of states are the appropriate unit for control measures. Although a regional approach is reasonable, blaming long-distance transport for all pollution effects may be an overstatement. The complexity of the Northeast area, especially the coastal megalopolis area, suggests that subregions should be considered in order to be fair. Aerosol transport illustrates how seasonal shifts in air movement raise questions about the origins of some pollutants. Elemental tracer techniques will help to determine if oxidation from aerosols is a factor in acid rain. 7 references. (DCK)

55832 (CONF-8210168—, pp 103-112) Understanding acid rain. Oppenheimer, M. (Environmental Defense Fund, New York, NY). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The author reviews current scientific understanding of acid deposition, with particular attention given to recent scientific evidence on the relationship between pollutant emissions and acid deposition. On the basis of his research and that of others, he concludes that reductions in sulfur emissions will lead to nearly comparable reductions in acidic sulfur deposition over the eastern US. He also concludes that long-range transport of sulfur pollutants over many hundreds of miles is a major source of acid deposition over parts of the Northeast. 32 references.

55833 (CONF-8210168—, pp 113-114) Potential constraint on Illinois coal. Poundstone, W.N. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The potential constraints on Illinois coal development because of acid rain must weigh economic as well as environmental factors. The accelerating rate of new evidence casting doubt on some earlier claims that Midwest utilities are the source of the problem suggests that passage of the Mitchell amendment to the Clean Air Act may place a heavy economic burden on the Ohio Valley without solving the problem. (DCK)

55834 (DOE/IR/10037—T8) Module nine: environmental trade-offs. (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 14p. NTIS, PC A02/MF A01. Order Number DE84000151.

This teaching module is designed to point out to students the major issues that must be faced when the need for energy comes into conflict with considerations of environmental protection. Some of the problems that exist regarding fossil fuels, water and air pollution and the cost of environmental control and energy use are demonstrated. (ACR)

55835 **(NP—3770371) Denmark - energy survey 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1983. 30p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770371.

The energy situation of this country is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade.

55836 **Energy - but how.** Nuernberg, Germany, F.R.; Stadt Nuernberg, Amt fuer Kulturelle Freizeitgesteltung (1982). 63p. (In German). Available from Stadt Nuernberg (Germany, F.R.).

In this materials publication the topics of the exhibition 'Energy-But How' of the South Centre for Political Education are taken up and considered in detail. Thereby the general relations of the energy problem shall be elucidated. A controversy of the principles and fundamental knowledge which arranged our technical and so-called civilized world shall be strived for. The increasing environmental contamination, the die-back of forests and the extinction of many animal species ought to be a sign of warning to handle our technology in a more responsible way and to respect the laws of nature. (orig./UA).

2904 Natural Resources

REFER ALSO TO CITATION(S) 55826, 55827, 55828, 55829, 56521

55837 **(BNL—51679, pp 43-58) US resource dependencies.** Morgan, J.D. (Bureau of Mines, Washington, DC). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

Adequate supplies of virtually every known material are a strategic necessity. US import reliance of selected minerals and metals is discussed. Strategic stockpiles have played a major role in US defense planning ever since World War II. The role that the Department of Defense plays in assuring adequate supplies of materials for the future is discussed. (DLC)

55838 **(GJBX—20(83)) Use of NURE and other data sets to characterize mineralized environments in the Wallace and Choteau NTMS quadrangles, Montana and Idaho.** Madson, M.E.; Burger, J.A. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations). Sep 1983. Contract AC13-76GJ01664. 49p. NTIS, PC E05/MF $7.75. Order Number DE84000953.

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Reconnaissance-scale National Uranium Resource Evaluation (NURE) data were used to recognize, characterize, and delineate mineralized environments in the Wallace and Choteau 1° x 2° quadrangles of Idaho and Montana. Data interpretation methods developed during the NURE program for the recognition of areas with potential for uranium deposits were used in this study to delineate localities representative of several different mineralized environments. The delineations were based on anomalous concentrations of elements in stream sediments and waters, and anomalous values of aerial radiometric potassium, equivalent uranium, equivalent thorium, and radioelement ratios. Aeromagnetic characteristics of the delineated localities were also derived from NURE data. Characteristics of NURE data were compared with known geology, structure, mineralization, and mining history of the project area. Recognition criteria were developed from NURE data for several mineralized environments in the project area. The most discrete criteria are for Coeur d'Alene-type deposits; less discrete criteria are also described for porphyry-type deposits, strata-bound deposits, and vein-type deposits related to intrusive and extrusive rocks. A total of 24 mineralized localities were delineated in this study. The localities were categorized as reference localities, representative of a particular mineralized environment; as marginal localities; or as follow-up localities, with NURE data characteristics that warrant further study. Three localities delineated in the study are follow-up localities and are considered by the authors to have potential for new or additional mineral resources. The Vermillion Peak-Moose Peak and Echo Mountain localities may host uranium-bearing, base- or precious-metal vein-type deposits. The Trout Creek locality has potential for additional gold-bearing placer deposits.

55839 **(NP—3910810) Colorado Energy-Activity Profile. Open File report No. 81-7.** Ladwig, L.R. (comp.). (Colorado Geological Survey, Denver (USA)). 1 Mar 1983. 284p. Colorado Geological Survey, Dept. of Natural Resources, Denver, CO 80203.

This report presents a compilation of data on various energy-related activities in Colorado, including location, resource base, type of extraction or conversion, geologic data, employment, energy consumption, and transportation. The activities include coal mines and conversion plants, oil shale mines and conversion plants, uranium mines and mills, geothermal wells, oil production and refining, natural gas production, pipelines, and electric power generation. (ACR)

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 55568, 55571, 55591, 56200, 56791

55840 **(DOE/EIA—0204(83/04)) EIA publications: new releases No. 64, July-August 1983.** (USDOE Energy Information Administration, Washington, DC). 1983. 32p. NTIS, PC A03/MF A01 - GPO. Order Number DE84000829.

This directory highlights: proceedings of petroleum supply symposium soon to be published; updated fact sheets just released; residential energy consumption survey reports on consumption and expenditures, and housing characteristics; impacts of world oil market shocks on the US economy; 1982 survey of US uranium marketing activity; and a complete listing of all EIA Data and Models.

55841 **(EUR—8293EN) Fund management for R + D under uncertainty.** Evers, J.J.M. (Commission of the European Communities, Luxembourg. Directorate-General for Science, Research and Development). 1983. 35p. Available from Commission of the European Communities, Luxembourg.

An integrated data base and budget allocation system is presented for the management for R and D funds. Concerning the R and D-projects it is assumed that: (i) progress can be checked on a limited number of sequentially ordered stages, (ii) the outcomes of the stages may be subjected to uncertainty concerning termination, (iii) execution of the stages can be speeded up by allocating (additional) subsidies, (iv) a stage can be subsidized only if its preceding stage is terminated successfully, (v) utilities or benefits of the projects are evaluated by one- or multi-dimensional cardinal data, and (vi) the utility data of all projects are mutually compatible. In this context, the system might be applied successfully for subsidy management over many projects with different budgetary needs.

55842 **(ORNL/CON—92/V3) Energy-Related Inventions Program: an overview of the evaluation.** Soderstrom, E.J.; Bronfman, L.M.; Rorke, M.G. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE84000293.

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The Energy-Related Inventions Program (ERIP) is jointly administered by the US Departments of Energy and Commerce. Grants were awarded for 165 of 208 inventions recommended by the National Bureau of Standards (NBS). Of the 165 inventions, 46 have been able to acquire follow-on financing from a variety of sources. Further, 35 of the inventions have reached the marketplace, and their cumulative sales to date total $178 million. An additional 10 inventions are now starting into production. Jobs that have been created directly by production related to the inventions total 756; additional spin-off jobs attributable to the inventions include component and material suppliers, jobbers, franchisees, and distributors. The program was recently evaluated at Oak Ridge Na-

tional Laboratory, with the following conclusions: (1) the evaluation process at NBS has been successful in identifying technically and economically feasible inventions, (2) the success rate for the program is about equivalent to the reported success rates of private venture capital firms, (3) the program is supporting inventions at a point in their development where they are supported by neither the venture capital community nor industry, and (4) the one-time DOE grants and the associated ERIP support to inventors have been successful in readying inventors for follow-on financing from the private sector.

55843 **(UCID—17271-83) E-Division activities report.** Barschall, H.H. (comp.). (Lawrence Livermore National Lab., CA (USA)). Jul 1983. Contract W-7405-ENG-48. 82p. NTIS, PC A05/MF A01. Order Number DE83017999.

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This report describes some of the activities in E (Experimental Physics) Division during the past year. E-division carries out research and development in areas related to the missions of the Laboratory. Many of the activities are in pure and applied atomic and nuclear physics and in materials science. In addition, this report describes development work on accelerators and on instrumentation for plasma diagnostics, nitrogen exchange rates in tissue, and breakdown in gases by microwave pulses.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 55482, 55487, 55492, 55493, 55500, 55503, 55504, 55739, 55753, 55754, 55756, 55777, 55778, 55779, 55780, 55781, 55787, 55863, 55867

55844 **(DOE/IR/10037—T7) Module seven: nuclear energy.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 43p. NTIS, PC A03/MF A01. Order Number DE84000235.

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There is an energy shortage of the conventional high use fossil fuels such as gasoline and oil. Because of this shortage, we must find alternate ways to generate electrical power. At present, there is no one perfect solution to this problem in sight, but some solutions are possible. One alternate fuel for the United States which is relatively abundant (over a 100 year supply) is coal. The other is nuclear fuel. In the future, other energy sources such as solar, wind, geothermal, etc., may become prominent, but presently they cannot be considered major sources of electrical power. In reality, the question is Do we want a generous supply of electrical energy in the United States. If the answer is yes, we must choose between coal, nuclear or a combination of both for our major source of energy. The virtues and drawbacks of nuclear energy are presented in this module.

55845 **(INIS-mf—8193) Benefits and risks of nuclear power.** Faessler, A. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). (Verband der Metallindustrie Baden-Wuerttemberg e.V., Stuttgart (Germany, F.R.)). 1982. vp. (In German). (CONF-8206208—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780012.

From VMI annual members' meeting; Fellbach, F.R. Germany (2 Jun 1982).

This popular report tries to compare advantages and risks of nuclear energy to one another. In comparison with other risks the author considers the remaining risk of nuclear energy acceptable. The main condition of a further development is, however, a political decision borne by the majority of the population. (UA).

55846 **(INIS-mf—8480) Nuclear power: how and why.** (UKAEA Headquarters, London). 1982. 9p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE83703518.

The subject is discussed, with special reference to the United Kingdom, under the headings: the need for nuclear power; Britain's experience (nuclear reactors); the nuclear process; how fuel is made; recycling fuel; wastes and their treatment; decommissioning; fast reactors; nuclear fusion; safety and radiation. (U.K.).

55847 **(INIS-mf—8481) Nuclear facts.** (UKAEA Headquarters, London). 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703519.

The subject is discussed as follows: the case for using nuclear energy (Britain's energy needs; energy policy); safety; transport of spent fuel; radiation (natural radioactivity); environment (land use of nuclear power plants; storage and disposal of radioactive wastes). (U.K.).

55848 **(INIS-mf—8482) Nuclear energy in view. Films, video and slide tape.** (UKAEA Headquarters, London). 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703520.

This leaflet advertises the availability of the following from UKAEA: film and video titles (nuclear fuel cycle; energy for all; power from the atom; using radioactivity; fast reactor; energy - the nuclear option; principles of fission; radiation); slide-tape packs (16 titles); other information services. (U.K.).

55849 **(INIS-mf—8483) Atoms at work.** (UKAEA Headquarters, London). 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703521.

This illustrated booklet discusses the following: atoms; fission of uranium; nuclear power plants; reactor types; plutonium (formation, properties, uses); radioactive waste (fuel cycle, reprocessing, waste management); nuclear fusion; fusion reactors; radiation; radioisotopes and their uses. (U.K.).

55850 **(INIS-mf—8489) Talking about nuclear power.** (UKAEA Headquarters, London). 1982. 2p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703522.

55851 **(INIS-mf—8490) Nuclear energy: a select bibliography.** (UKAEA Headquarters, London). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703523.

The titles are divided between: historical (6); official (17); general (32). The aspects covered include: UK government policy; energy policy; economics; safety; hazards; reactor types; radioactive waste management; environment; socio-economic.

55852 **(INIS-mf—8491) Nuclear power publications.** (UKAEA Headquarters, London). 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703524.

This booklet lists 69 publications on nuclear energy available free from some of the main organisations concerned with its development and operation in the UK. Headings are: general information; the need for nuclear energy; the nuclear industry; nuclear power stations; fuel cycle; safety; waste management. (U.K.).

55853 **(INIS-mf—8492) Glossary of atomic terms.** (UKAEA Headquarters, London). 1982. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703525.

This glossary, containing almost 400 terms, has been compiled to help people outside the atomic energy industry to understand what those inside it are saying. It is not intended to be a definitive dictionary of scientific or technical terms, nor does it aim to cover terms that are in general use in science and technology. A list of about 100 initials and acronyms will be found at the end.

55854 **(INIS-mf—8493) Nuclear spin-off.** (UKAEA Headquarters, London). 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703526.

This booklet gives examples of 'nuclear spin off', from research programmes carried out for the UKAEA, under the following headings; non destructive testing; tribology; environmental protection; flow measurement; material sciences; mechanical engineering; marine services; biochemical technology; electronic instrumentation. (U.K.).

55855 **(INIS-mf—8497) Energy and the need for nuclear power.** (UKAEA Headquarters, London). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703527.

The subject is discussed under the headings: fuel and mankind (world population estimates); fuel supply and demand (world nuclear and total primary energy demand forecasts); oil dependence; oil, gas and coal (world oil production and consumption; world coal reserves); nuclear option (consumption of nuclear energy in Western Europe; nuclear plant worldwide at December 1981; uranium reserves 1981); renewable resources; price of energy; Britain's need for nuclear power. (U.K.).

2907 Transport And Storage

REFER ALSO TO CITATION(S) 55812, 55814

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 55721, 55925

2910 Conservation

REFER ALSO TO CITATION(S) 55893, 55895, 55896, 55898, 55900, 55901, 55910

55856 (CONF-8210168—, pp 21-28) **Unpredictability of the energy future.** Freeman, S.D. (Tennessee Valley Authority, Knoxville, TN). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Mr. Freeman observes that energy conservation, not production, is the major contributor to energy supplies during the past nine years, as is evident in the declining energy-consumption/economic-output ratio. When compared to the costs of both conventional and renewable-energy sources, conservation is a clear winner despite the long-held belief that conservation would be incompatible with economic growth. The Tennessee Valley Authority's conservation and renewable-energy programs demonstrate that demand can be managed, and they justify the research and retooling investments that will make the US more energy-efficient. (DCK)

55857 **Department of Energy Fiscal Year 1984 authorization (conservation programs and the Energy Information Administration). Hearing before the Subcommittee on Energy Conservation and Supply of the Committee on Energy and Natural Resources, United States Senate, Ninety-Eighth Congress, First Session to review the Department of Energy's Fiscal Year 1984 budget request, March 8, 1983.** Washington, DC; Government Printing Office (1983). 124p.

Joseph J. Tribble and J. Erich Evered testified on the 1984 budget requests for DOE's conservation programs and the Energy Information Administration (EIA). Mr. Tribble described the conservation and renewable-energy programs which will continue despite the improved energy-supply situation and with federal support for that research which industry cannot handle alone. He disagreed with committee chairman Lowell Weicker over continued support for state and local energy grants and the transfer of funds for weatherization programs. Mr. Evered described EIA's 1983 accomplishments and its objectives for 1984. An appendix includes correspondence and responses to additional committee questions. (DCK)

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 55835, 55859, 55865, 55866, 55867

55858 (EUR—8035EN) **Case study, candidate technologies to relieve the European energy systems: Ireland.** Killen, L. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). 1982. 50p. Available from Commission of the European Communities, Luxembourg.

This report contains the results for Ireland of the case study entitled "Candidate Technologies to relieve the European Energy System", using the EFOM-12-C model. The previous case study. "The Escalating Supply Rationing" examined the sensitivity of the European energy systems to progressive restrictions in energy imports. The result for Ireland was not flexible in this regard, with a maximum saving of only 6% in the cost of energy imports possible, and this was achieved at the expense of an increase of 19% in total system cost. This reflects the relatively insecure situation in which Ireland finds itself, with very few indigenous energy resources and therefore a high dependence upon imported energy, and in particular upon imported oil. This case study which allows the introduction of new technologies is therefore of considerable interest, given that our conventional indigenous resources are so few, though it must be said that many new technologies may not be applicable to an energy system as small as Ireland's in the 40-year time horizon being studied.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 55431, 55765, 55857

55859 (CONF-8210168—, pp 3-10) **Illinois: the key to America's energy transition.** Percy, C.H. 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Senator Percy suggests that Illinois should convert problems into assets; for example, by using surplus corn to produce ethanol, thus solving the corn problem and helping to diversify energy sources. He also recommends taking advantage of new combustion and pollution-control technology to push Illinois' high-sulfur coal deposits; expanding private-sector efforts to handle nuclear wastes instead of federal away-from-reactor (AFR) dumping sites, one of which may be Illinois; and focusing on human ingenuity to develop new energy and conservation technologies. Percy comments on existing and pending legislation and his efforts to change energy policies and to secure energy supplies. (DCK)

55860 (CONF-8210168—, pp 13-20) **Changing role of government in energy policy.** Mares, J.W. (Dept. of Energy, Washington, DC). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Mr. Mares notes that the public's perception of energy and energy technologies involving coal and nuclear power requires an understanding and an assessment of the energy situation if the free market is to choose an appropriate energy mix. This perception has changed recently as the public has recognized that US resources are abundant, but government solutions cannot be instantaneous. That the government has a role is acknowledged, but a realistic public policy also sees that the energy-related industries are developing more-efficient, economical, and environmentally sound fuels and technologies. These changes are already evident in the approach to coal technology and synthetic-fuels development, but must also be applied to nuclear issues. (DCK)

55861 (CONF-8210168—, pp 37-48) **Illinois' state energy planning.** Witte, M.B. (Illinois Dept. of Energy and Natural Resources, Springfield). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Summaries of early results from the Illinois Energy Policy and Planning Act of 1979, as described in a six-volume series, show shifts in the energy-economy link that differ from those of other states. A comparison of two energy futures, increased energy efficiency under the business-as-usual path and under the state energy plan illustrate the potential advantages of the state program. 2 figures. (DCK)

55862 **(DOE/S—0014/1) National Energy Policy Plan.** (USDOE, Washington, DC). Oct 1983. 27p. NTIS, PC A03/MF A01. Order Number DE84000246.

Report to the Congress.

Since the third National Energy Plan in 1981 total energy efficiency has increased, domestic energy resources are being developed more effectively, oil prices have declined, US dependence on

foreign energy sources has diminished, and the nation's vulnerability to energy supply disruptions has been reduced markedly. The policy goal is an adequate supply of energy at reasonable costs. Strategies include minimizing federal control and involvement in energy markets while maintaining public health and safety and environmental quality and promoting a balanced and mixed energy resource system. Federal programs and actions in energy are reviewed.

55863 **(INIS-mf—8505) NEA activities in 1981. 10. Activity report.** (Nuclear Energy Agency, 75 - Paris (France)). 1982. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703531.

This report describes the main features of the Agency's work during 1981 and discusses the state and prospects of the nuclear industry in OECD countries. Trends in nuclear power, radiological and environmental impacts of nuclear fuel cycle activities, nuclear safety research and licensing, nuclear law, nuclear development and fuel cycle studies technical co-operation, nuclear science organisation and administration are reviewed.

55864 **(N—8323662) Federal Energy and Mineral Resources Act of 1982.** (Committee on Energy and Natural Resources (U.S. Senate), Washington, DC). 1982. 406p. (GPO—98-104). Avail: Committee on Energy and Natural Resources.

A bill to enhance the ability of the administration to collect royalites due from Federal and Indian mineral leases is discussed.

55865 **(NP—3770347) Kuwait - energy survey 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 11p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770347.

The energy situation of this country is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade.

55866 **(NP—3770348) Egypt - energy survey 1981/82.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1983. 37p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770348.

The energy situation of this country is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 55349, 55352, 55419, 55423, 55426, 55427, 55428, 55431, 55437, 55438, 55439, 55440, 55451, 55460, 55727, 55830, 55831, 55832, 55833, 55839, 55839, 55839, 55839, 55872, 55883, 56240

55867 **(CONF-8210168—) Coal and nuclear power: Illinois' energy future.** (Illinois Univ., Chicago (USA). Energy Resources Center). 1982. 293p. NTIS, PC A13/MF A01. Order Number DE83014854.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

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This conference was sponsored by the Energy Resources Center, University of Illinois at Chicago; the US Department of Energy; the Illinois Energy Resources Commission; and the Illinois Department of Energy and Natural Resources. The theme for the conference, Coal and Nuclear Power: Illinois' Energy Future, was based on two major observations: (1) Illinois has the largest reserves of bituminous coal of any state and is surpassed in total reserves only by North Dakota, and Montana; and (2) Illinois has made a heavy commitment to the use of nuclear power as a source of electrical power generation. Currently, nuclear power represents 30% of the electrical energy produced in the State. The primary objective of the 1982 conference was to review these two energy sources in view of the current energy policy of the Reagan Administration, and to examine the impact these policies have on the Midwest energy scene. The conference dealt with issues unique to Illinois as well as those facing the entire nation. A separate abstract was prepared for each of the 30 individual presentations.

55868 (CONF-8210168—, pp 51-58) **Illinois coal: a focus for development.** Benda, G. (Illinois Dept. of Energy and Natural Resources, Springfield). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The development of Illinois coal resources under changing environmental regulation reflects the need to use high-sulfur coal for power and steam generation and for synthetic-fuels development and the need for continued research in coal desulfurization. An overview of the Illinois Coal Development Program outlines its major elements, its bond fund program, and its integration with other state energy and research programs. 1 table. (DCK)

55869 **(DOE/EIA—0035(83/08)) Monthly energy review, August 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 25 Aug 1983. 113p. NTIS, PC A06/MF A01 - GPO. Order Number DE84000026.

This report presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the US. Also included are data on the international production of crude oil, consumption and prices of petroleum products (gasoline, distillate fuel oil, residual fuel oil, liquefied petroleum gases, aviation fuels, natural gas, and electricity), petroleum stocks, and production of electric power from nuclear power plants. Data are also presented on consumption according to end-use sector (industry, commercial, residential, transportation and electric utilities). (DMC)

55870 **(NP—3770382) Deutsche Shell A.G.: Balance '81.** (Deutsche Shell A.G., Hamburg (Germany, F.R.)). 1981. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83770382.

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The present annual report describes structure and activities of the German Branch of one of the largest mineral oil companies. Further details are provided on social balance, balance of visible and invisible items, capital flow accountancy balance sheet of the 31.12.81, profit - and loss account, report of the supervisory board. Supplement: figures on social balance, balance of visible and invisible items, balance sheet, profit and loss account.

55871 **(ORNL/TM—8850) Application of adjoint-sensitivity theory to a liquid-fuels supply model.** Alsmiller, R.G. Jr.; Barhen, J.; Horwedel, J.E.; Lucius, J.L.; Drischler, J.D. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 46p. NTIS, PC A03/MF A01. Order Number DE84000295.

Adjoint sensitivity theory has been applied to a liquid fuels supply model to determine the sensitivity of calculated results to the parameters in the model. The power of the adjoint sensitivity methodology is that it provides, in principle, an efficient means of calculating the sensitivity, dR/dx, of any calculated result R to every parameter x in the model. The liquid fuel supply model considered is one of a class of models that may be constructed from the Generalized Equilibrium Modeling System (GEMS) developed by Decision Focus, Inc., Los Altos, California. It is shown that for this class of models the lengthy development effort that is usually associated with applying the adjoint sensitivity methodology can be avoided by using the GEMS program to evaluate the large number of partial derivatives that are needed to apply the methodology. 8 references, 1 figure, 3 tables.

2950 Hydrogen And Synthetic Fuels

55872 (CONF-8210168—, pp 193-198) **Synthetic-fuels industry: a future outlook.** Miller, E.S. (US Synthetic Fuels Corp., Washington, DC). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Synthetic fuels are destined to play a role in America's energy future. They will eventually be produced from domestic resources that are found in great abundance. Only 10% of our fossil-energy reserves are conventional oil and gas, the balance being in solid forms needing only an economic and clean way to be converted to liquids and gases. There is an economic and strategic rationale for the federal government to provide a stimulus for commercial synthetic-fuel development through the Energy Security Reserve Fund and the Synthetic Fuels Corporation.

55873 **Role of synfuels in our future energy supply.** Schroeder, V. (US Synthetic Fuels Corp., Washington, DC). *Industrial Development;* **151**: No. 2, 22-24(Mar-Apr 1982).

An adequate supply of energy for America's future needs can be met by coupling our existing conservation efforts with a self-sustaining synthetic-fuels industry, according to the president of the US Synthetic Fuels Corp. In June 1980, the Energy Security Act authorized the establishment of the Corporation to develop a commercial synthetic-fuels industry. Progress that has been made by the Corporation is discussed as well as general observations on the US energy scene.

2960 Electric Power

REFER ALSO TO CITATION(S) 55353, 55440, 55576, 55577, 55578, 55720, 55727, 55839, 55926, 56307

55874 **(CONF-830938—1) Past, present, and future roles of a national laboratory in capacity planning.** Hamblin, D.M. (Oak Ridge National Lab., TN (USA)). 14 Sep 1983. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE84000728.

From Symposium on computer analysis of electric load forecasting and generating capacity expansion; Columbus, OH, USA (14 Sep 1983).

This paper initially discusses research areas of ORNL involvement in capacity planning. This paper then discusses the Client Problem: Should Oak Ridge provide services for the regulators and/or the regulated? Next, the paper highlights evidence that there may be an upcoming electric capacity shortage - based upon a focused regional analysis and some general national observations. Fourth, the paper discusses some new directions which ORNL is currently pursuing in forecasting the demand side of capacity planning - with emphases placed upon variable level of detail and cost-effective for regulator operation. Finally, the paper concludes with a challenge to any and all mid-to-long term capacity planners to cost-effectively beat the weighted electricity growth prediction of GNP growth plus or minus regional development possibilities.

55875 (CONF-8210168—, pp 29-36) **Governmental regulation of coal and nuclear power plants.** Alm, A.L. (Harvard Univ., Cambridge, MA). 1982. NTIS, PC A13/ MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Serious financial damage came to US electric utilities over the past decade as a result of two oil-price shocks and environmental regulations; today, however, thanks to the 1982-83 bull-market, utility stock values are on the upswing. Continuing financial problems and efforts in many states to shift to elected commissions, however, will keep the regulatory environment uncertain. The economic costs of utility regulation and, particularly, the cancellation of plants already under construction and licensing, suggest five steps that would be helpful: (1) restoring financial integrity by increasing real rates of return, (2) financing oil conversion, (3) streamlining nuclear licensing, (4) experimenting with levelized or inflation-adjusted rate structures, and (5) expanding the Public Utility Regulatory Policies Act. (DCK)

55876 (CONF-8210168—, pp 293-294) **Utilities, regulators, and consumers.** Paulson, J. (Assistant Illinois Attorney General, Springfield). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The interaction between investor-owned utilities, regulators, and consumers will determine the future of Illinois' electric utilities. As consumers demand more say in rate decisions, probably through elected rather than appointed regulators, the balance of power will shift from an emphasis on shareholder to consumer interests. (DCK)

55877 (CONF-8210168—, pp 295-302) **Future Illinois utility market.** Hasten, M.V. (Illinois Commerce Commission, Springfield). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The future prospects for electric utilities in Illinois are good for a reliable and a competitive supply of electricity to serve the state's needs. The author anticipates a gradual moderating of the costs to provide electricity that have caused concern among consumers, but he warns that the lessons of the past decade must not be lost on utility managers or regulators in the future.

55878 (CONF-8210168—, pp 303-306) **Look at the 70's to project the 80's.** Wells, C.W. (Illinois Power Co., Decatur). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

The author observes that there is no reason why the prospects for electric utilities in Illinois should not be good if the public and regulatory bodies allow the utility to remain or become financially healthy; if the utility operates as efficiently as possible and stays alert to its customers' present and future needs; if the world, national, and state economy provides the opportunity to prosper; and if all parties begin to agree and work toward common goals that are in the public interest.

55879 **(DOE/CE—0046) Systems Research. Program research.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Electric Energy Systems Div.). Aug 1983. 121p. NTIS, PC A06/MF A01. Order Number DE83017653.

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This program addresses the long-range systems oriented technical problems facing electric energy systems. Chapters describe technical activities in the fields of dynamic security assessment, emergency operating state control, restorative state control, complex system stability, generating plant control, multiterminal HVDC systems, operations scheduling, simulation tools and modeling concepts, large scale system structuring, industry functional modeling, and technology integration. (DLC)

55880 **(DOE/EIA—0226(83/07)) Electric power monthly, July 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 5 Oct 1983. 43p. NTIS, PC A03/MF A01 - GPO. Order Number DE84001289.

This report includes comprehensive information about the electric utility industry in the United States. During July 1983, net generation by electric utilities in the United States was 220,074 gigawatthours (GWh). On a year-to-date basis, net generation at the end of July 1983 was 1.3 percent less than for the same period in 1982. In July, coal accounted for 55.3 percent of all electricity produced, petroleum for 6.7 percent, gas for 13.5 percent, nuclear power for 11.6 percent, hydroelectric power for 12.7 percent, with the remaining 0.3 percent from geothermal, wood, and waste. In July 1983, electric utilities consumed 60,390 thousand short tons of coal. Petroleum consumption in July 1983 was 24,616 thousand barrels, while gas consumption was 314,373 million cubic feet. On a year-to-date basis, coal consumption at the end of July 1983 increased 0.2 percent from the same period in 1982, petroleum consumption decreased 12.5 percent, and gas consumption decreased 15.1 percent.

55881 **(INIS-BR—58) Comparison of three energy types : nuclear, hydroelectric and thermoelectric, in Brazil, up to 2050. Possible scenarios based on a cost benefit analysis.** Mohallem, N.D.S. (Minas Gerais Univ., Belo Horizonte (Brazil). Escola de Engenharia). Dec 1982. 132p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780016.

To pursue a semi-quantitative analysis of Brazil's electric energy production-consumption problem from now on until the 2050 year, is done. The main energy sources under consideration will be hidroelectric, thermoelectric (coal) and nuclear. It is assumed that the energy consumption will be within a specified minimum and maximum level of growth rate and for the limiting cases, the supply by hidroelectricity will be considered, and further supply from other sources will also be considered in the case which hidroelectric potential becomes exausted. It is intended that the best energy alternatives will be devised from today's reality, such as the almost exausted hidroelectric potential in the southwest region and the building of a growing nuclear program. The analysis will be oriented in the viewpoint of the cost-benefit in the economic, social and ecological areas. (Author).

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 55427, 55584, 55869, 55905, 55906, 55907, 55908

55882 **(DOE/EI/11145—T1) 1982 Census of Manufacturers: fuels and electric energy consumed. Part 2. States and standard metropolitan statistical areas by major industry groups.** (Bureau of the Census, Washington, DC (USA). Industry Div.). Jun 1982. Contract AI01-81EI11145. 172p. NTIS, PC A08/MF A01. Order Number DE83017808.

This report presents estimates of the quantity and cost of purchased fuels and electric energy consumed by manufacturing plants in 1981. In 1981, the United States consumption of purchased fuels and electric energy for heat and power by manufacturing establishments was 11.6 quadrillion British thermal units (Btu's). Expenditures for fuels and electric energy during 1981 totaled $55.3 billion compared to $48.3 billion in 1980. Increases in expenditures for natural gas and electric energy accounted for most of this increase. The average cost per million Btu's of energy consumed in 1981 was $4.78, compared to $4.05 in 1980. The most expensive source of energy in 1981, as in the past, was purchased electric energy at $11.23 per million Btu's. Electric energy accounted for 46% of total expenditures, while at the same time accounting for only 20% of total energy consumed. The total Btu equivalent of fuel stocks (distillate and residual fuel oil, coal, coke, and LPG) on hand at manufacturing establishments at the end of 1981 amounted to 488.6 trillion Btu's or 5% of the total purchased fuels in 1981 (not including purchased electric energy). 141 pages of tabulated data.

55883 **(DOE/EI/11145—T2) 1982 census of manufactures: fuels and electric energy consumed. Part 1. Industry groups and industries. Subject series.** (Bureau of the Census, Washington, DC (USA). Industry Div.). Jun 1983. Contract AI01-81EI11145. 45p. NTIS, PC A02/MF A01. Order Number DE83018269.

This report presents estimates of the quality and cost of purchased fuels and electric energy consumed by manufacturing plants in 1981. Although this report has been included as part of the overall 1982 Census of Manufactures publication series, the information was collected for the year 1981 as part of the annual survey of manufacturers. For a more detailed discussion of scope and coverage, see appendixes. The 1980 data shown in this report may differ from that published in the 1980 report due to revisions carried after that publication was issued.

55884 **(DOE/EIA—0321/1(81)) Residential energy consumption survey: consumption and expenditures, April 1981 through March 1982. Part 1. National data.** Thompson, W. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Sep 1983. 206p. NTIS, PC A10/MF A01 - GPO. Order Number DE83018196.

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This report presents data on the US consumption and expenditures for residential use of natural gas, electricity, fuel oil and kerosene, and liquefied petroleum gas (LPG) during the year from April 1981 through March 1982. The consumption and expenditures data are based on actual household bills obtained, with the permission of the household, from the companies supplying energy to the household. These data come from the 1981 Residential Energy Consumption Survey (RECS), the fourth in a series of comparable surveys beginning in 1978. Each survey is based on a different sample of households. This summary gives the highlights of a comparison of the findings for the four years. The data cover all types of occupied housing units in the 50 States and the District of Columbia including single-family units, apartments, and mobile homes. For households with indirect energy costs, such as costs that are included in the rent or paid by third parties, the consumption and expenditures are estimated and included in the figures reported here.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 55571, 55604, 55614, 55839, 55857

55885 **(DOE/CS/10135—T1) Development of a commercialization strategy and performance of special projects for the Office of Inventions and Small-Scale Technology. Final report.** (Battle (Mark) Associates, Inc., Washington, DC (USA)). 27 May 1981. Contract AC01-80CS10135. 64p. NTIS, PC A04/MF A01. Order Number DE83017866.

In developing evaluation criteria, issues relating to the application of appropriate business and investment techniques were given careful consideration. A discussion of specific criteria used and projects selected is presented. The final plan developed for each project is discussed in detail. The national commercialization plan is presented. The DOE regional manager survey is described and the results are summarized. (MHR)

30 DIRECT ENERGY CONVERSION

3005 Fuel Cells

55886 **(AD-A—129388/5) On-site fuel cell application analysis. Final report Sep 81-Dec 82.** Staniunas, J.W. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Feb 1983. 79p. (PSD/UTC-FCR—4513-1). NTIS, PC A05/MF A01.

This program evaluated the energy conservation and economic potential of on-site fuel cell service for Air Force Logistic Command Facilities. Numerous facilities were examined at Wright-Patterson AFB, Hill AFB, and Robins AFB. One facility was selected at each base for detailed benefit and integration analyses. Results of the analyses are presented.

55887 **(AD-A—129398/4) Megawatt fuel cell systems analysis. Final report Sep 81-Jul 82.** Trocciola, J.C. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Feb 1983. 66p. (PSD/UTC-FCR—4513). NTIS, PC A04/MF A01.

This analysis effort evaluated the operational and economical benefits of utilizing a megawatt fuel cell to provide prime electrical power and thermal energy to an Air Force Logistics Center. Issues motivating this analysis include concerns with the Air Logistics Center's vulnerability to electrical grid and fuel supply disruption, and energy conservation/self sufficiency goals established by the Air Force Logistics Command. This effort determined that megawatt fuel cells can provide an economical alternative for survivable power systems when compared to electrical grid/diesel boiler systems currently used.

55888 **(CONF-831104—2) Molten-carbonate fuel cells - development status.** Pierce, R.D.; Ackerman, J.P. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84000612.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

MCFC development has progressed to the point where demonstrated single-cell performance is highly attractive for power generation (0.77 V at 160 mA/cm² at 1 atm). The emphasis of the DOE program, therefore, was focused on the development of stacks of cells leading to the scaleup of components and manufacturing processes for MCFCs. Accordingly, two major contractors, United Technologies Corporation (UTC) and General Electric (GE), were selected and in 1979 were awarded DOE development contracts with the same four tasks: (1) develop a reference power plant design, (2) develop components and stack designs, (3) develop plans and fabrication facilities necessary for progressing to prototype-stack testing, and (4) verify cell operation on coal derived gas. The expectation is that the subsequent prototype testing of a full-size MCFC stack in about 1988 will be a joint venture between private industry and the government, and that this joint venture will be followed by a demonstration plant that will be largely financed with private funds. The present program is concentrating heavily on the development of subscale stacks. UTC has operated several stacks and is developing solutions to the problems uncovered. GE is working on an alternative stack design developing MCFCs that will reform methane internally. This paper will review the status of these studies and mention supporting work underway by these and other researchers.

55889 **(N—8323371) Modeling and technical use of gas evolving electrodes. Part 2: Modeling of gas-evolving electrolyzers with free electrolyte circulation.** Schleiff, M.; Thiele, W. (National Aeronautics and Space Administration, Washington, DC (USA)). Mar 1983. 12p. (NASA-TM—77045). NTIS, PC A02/MF A01.

Transl. from English Chem. Tech. (Leipzig); 34: No. 5, 250-252 (1982).

In an electrochemical reactor with gas-evolving electrodes, the transporting action of the gas bubbles can be used to move the electrolyte in a cycle flow, when the structure of the flow channels is suitable. For an electrolysis cell with such a circulation system a mathematic model was set up and evaluated. It is shown that in this manner, a rapid flow through the electrode gap can be achieved without additional energy consumption, in addition to a low gas fraction and a low cell voltage. The cell voltage and the attainable cycle spread are investigated as a function of the geometric parameters for their optimum values.

55890 **(N—8323698) Evaluation of solid oxide fuel cell systems for electricity generation. Interim;Final Report.** Somers, E.V.; Vidt, E.J.; Grimble, R.E. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Dec 1982. 35p. NTIS, PC A03/MF A01.

Air blown (low BTU) gasification with atmospheric pressure Solid Electrolyte Fuel Cells (SOFC) and Rankine bottoming cycle, oxygen blown (medium BTU) gasification with atmospheric pressure SOFC and Rankine bottoming cycle, air blown gasification with pressurized SOFC and combined Brayton/Rankine bottoming cycle, oxygen blown gasification with pressurized SOFC and combined Brayton/Rankine bottoming cycle were evaluated.

55891 **(N—8324571) Pore size engineering applied to the design of separators for nickel-hydrogen cells and batteries.** Abbey, K.M.; Britton, D.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. 11p. (CONF-830812—56; NASA-TM—83386; E—1663). NTIS, PC A02/MF A01.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

Pore size engineering in starved alkaline multiplate cells involves adopting techniques to widen the volume tolerance of individual cells. Separators with appropriate pore size distributions and wettability characteristics (capillary pressure considerations) to have wider volume tolerances and an ability to resist dimensional changes in the electrodes were designed. The separators studied for potential use in nickel-hydrogen cells consist of polymeric membranes as well as inorganic microporous mats. In addition to standard measurements, the resistance and distribution of electrolyte as a function of total cell electrolyte content were determined. New composite separators consisting of fibers, particles and/or binders deposited on Zircar cloth were developed in order to engineer the proper capillary pressure characteristics in the separator. These asymmetric separators were prepared from a variety of fibers, particles and binders.

55892 **Fuel cell power plants for electric utilities and hydrogen.** Fickett, A.P. (Electric Power Research Inst., Palo Alto, CA). *International Journal of Hydrogen Energy;* **8**: No. 8, 617-622(1983).

Phosphoric acid fuel cell power plants are nearing commercial status as multimegawatt electric power generators. These power plants are being designed to use a wide range of utility fuels that are converted to hydrogen within the power plant. This paper explores the status of fuel cell power plants and the prospects for pure hydrogen as the fuel.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

55893 **Energy conservation in Kenya's modern sector: progress, potential, and problems.** Schipper, L.; Meyers, S. (Lawrence Berkeley Lab., CA). *Energy Policy;* **11**: No. 3, 225-234(Sep 1983). Contract W-7405-ENG-48.

The importance that less-developed countries (LDCs) should attach to energy conservation has been a subject of some controversy. Results are presented here of a study that investigated efforts to improve efficiency of energy use in Kenya. It is shown that many firms have made substantial progress in reducing their energy use per unit of output. Although these are encouraging signs, a number of barriers were found that prevent the realization of the potential to improve the efficiency of energy use. We conclude that assistance to facilitate energy-efficient development in LDCs is as important in the long term, and probably more important in the short term, as aid to expand local energy supplies. 4 tables.

3201 Buildings

REFER ALSO TO CITATION(S) 55930

55894 **(AD-A—129257/2) Utilizing the optimum start/stop control strategy for heating Naval Civil Engineering Laboratory. Final report Jan 81-Mar 82.** Sanchez, I. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Apr 1983. 35p. (NCEL-TN—1663). NTIS, PC A03/MF A01.

NCEL has successfully implemented a single-building controller that measures indoor and outdoor temperatures to determine optimum times to start and stop steam heat. Significant energy and dollar savings have been demonstrated. Operating experience with the controller and details on its hardware and software are presented in this report.

55895 **(BNL—51698) Analysis of space heating and domestic hot water systems for energy-efficient residential buildings.** Dennehy, G. (Brookhaven National Lab., Upton, NY (USA)). Apr 1983. Contract AC02-76CH00016. 75p. NTIS, PC A04/MF A01. Order Number DE84000441.

An analysis of the best ways of meeting the space heating and domestic hot water (DHW) needs of new energy-efficient houses with very low requirements for space heat is provided. The DHW load is about equal to the space heating load in such houses in northern climates. The equipment options which should be considered are discussed, including new equipment recently introduced in the market. It is concluded that the first consideration in selecting systems for energy-efficient houses should be identification of the air moving needs of the house for heat distribution, heat storage, ventilation, and ventilative cooling. This is followed, in order, by selection of the most appropriate distribution system, the heating

appliances and controls, and the preferred energy source, gas, oil, or electricity.

55896 **(CERL-TR-E—186) Analysis of facilities' energy-use patterns. Final report.** Sliwinski, B.J.; Elischer, E. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1983. 75p. NTIS, PC A04/MF A01. Order Number DE84900056.

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The development of methods for estimating building energy consumption based on analysis of weather and energy use data is described. Equations are presented for estimating Army facilities' energy consumption based on daily heating and cooling degree days. The results of the regression analysis indicated that these equations can be used to estimate energy consumption for aggregates of 10 or more buildings. The equations are useful for all types of Army buildings. Time series analysis of facilities' electrical energy consumption is also described. This analysis provides the Facilities Engineer with a basis for estimating daily electric energy consumption and a methodology for using accurate short-term electrical metering to estimate daily average electrical consumption.

55897 **(DOE/CE/15147—T1) Energy-Kote study program, 1st phase. Final report.** Donoghue, P.J. (N. H. Industries, Inc., North Tonawanda, NY (USA)). 1 Sep 1983. Contract FG01-82CE15147. 9p. NTIS, PC A02/MF A01. Order Number DE83017668.

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The Energy-Kote study was proposed as a two-phase project to develop a comprehensive design methodology for radiant heating in the build environment. The objective of the first phase of the study was to research the available literature and design information to determine if enough data was published to develop a credible design methodology. Considering the fact that where a perfectly diffuse emitting surface is employed such as the Energy-Kote panel the radiant heat flux in the space is constant so the effect on all surfaces is constant. The temperature of the inside surfaces varies based on the thermal resistance (R) of each of the boundaries, however, the change in R (ΔR) of each boundary should be the same as it is based on the radiant heat flux rather than the surface temperature. In the proposed design method a value of ΔR of 0.5 was used based on the empirical data available. This value correlates well with results and is consistent with the claims made by all manufactures of radiant panels.

55898 **(DOE/EIS—0095) Expanded Residential Weatherization Program. Draft environmental impact statement.** (USDOE Bonneville Power Administration, Portland, OR). Aug 1983. 381p. NTIS, PC A17/MF A01. Order Number DE84000886.

BPA proposes to expand its present Residential Weatherization Program. The present BPA program excludes certain types of residences from receiving air-infiltration reducing (tightening) measures. These tightening measures are storm windows and doors, weatherstripping, caulking, and electrical switchplate and outlet gaskets. Under the proposed expanded program, all presently excluded residences would be eligible to receive tightening measures. This proposed program would meet the intent of the Pacific Northwest Electric Power Planning and Conservation Act (Regional Act) and would aid in insuring an adequate, reliable, economical, and efficient electrical energy system for the region. This Environmental Impact Statement (EIS) evaluates the effects of three alternative actions for the BPA weatherization program: No Action; Proposed Action; Delayed Action. The major effects examined include air quality (indoor and outdoor), public health, energy, socioeconomic and institutional.

55899 **(NP—3770390) Studies on construction physics and structural design with regard to the dimensioning and design of a residential building's walls and floors with soil contact.** Oswald, R. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bauwesen). 21 Mar 1980. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770390.

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Interest on economical energy consumption has risen throughout the last years as a result of the huge price increase and the scarcity of fossile fuels to be expected. Heating energy demand accounts for the largest consumption share on the sector of private households. Reduction of this share by reducing the transmission loss has been one of the ideas. Considerations of heat exchanging surfaces of buildings have so far left out those surfaces with earth contact. Information possibilities and knowledge on thermal protection of components with earth contact are rare. This paper tries to remedy matters.

55900 **(ORNL/CON—97) Thermal mass assessment: an explanation of the mechanisms by which building mass influences heating and cooling energy requirements.** Childs, K.W.; Courville, G.E.; Bales, E.L. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 88p. NTIS, PC A05/MF A01. Order Number DE84000654.

The influence that building mass has on energy consumption for heating and cooling has been the subject of some controversy. This controversy is, in part, due to a lack of understanding of the heat transfer mechanics occurring within a building and of how they affect energy usage. This report offers a step-by-step development of the principles of heat transfer in buildings as they pertain to thermal mass. The report is targeted for persons who are unfamiliar with the topic of thermal mass, but who possess some technical background. It is concluded that for the mass of a building to reduce energy usage, the building must undergo alternating periods of net energy gain and loss. In other words, during the heating season the indoor temperature must at times float above the thermostat set point temperature to reduce energy consumption. During the cooling season, the indoor temperature must occasionally drop below the set point temperature. Other issues addressed include the effects of mass on peak loads, equipment cycling, thermostat setback, and comfort. Strategies to maximize benefits of mass are discussed.

55901 **(ORNL/CON—132) Residential conservation service in Connecticut: evaluation of the CONN SAVE program.** Hirst, E.; Hu, P.S.; Taylor, E.F. Jr.; Thayer, K.M.; Groeneman, S. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 109p. NTIS, PC A06/MF A01. Order Number DE84000292.

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CONN SAVE is a nonprofit consortium of six electric and gas utilities in Connecticut. CONN SAVE was established to deliver services mandated by the federal Residential Conservation Service. During its first two years of operation, CONN SAVE conducted energy audits among 85 thousand of the 844 thousand Connecticut homes eligible for the program. A detailed quantitative evaluation of the program conducted by Northeast Utilities and Oak Ridge National Laboratory is described. The evaluation involved collection of several types of data from CONN SAVE, fuel suppliers, and households: demographic and economic characteristics and information on recent conservation actions from on-site home interviews, home energy audits for both CONN SAVE participants and nonparticipants, and fuel consumption records for homes heated with electricity, gas, or oil. Altogether, data on 300 participant and 900 nonparticipant homes were obtained. These data were used to address several issues: the potential for residential energy conservation in Connecticut, differences and similarities between participants and nonparticipants, energy savings due to conservation measures installed after Spring 1981 (when the participants received their CONN SAVE audits), and program economics.

55902 **(ORNL/CON—137) Study of currently available commercial and apartment building energy conservation audits: Commercial and Apartment Conservation Service (CACS) program.** Kamp, G.; Patel, K.; Carlisle, N. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE84000655.

The results of a study conducted to identify and analyze currently available commercial and apartment building energy conservation audits is summarized. The results of this study were used to develop the energy conservation audit requirements that will be incorporated in the Commercial and Apartment Conservation Service (CACS) Program. The CACS Program is designed to make low or

no cost utility conducted energy conservation audits available for small commercial and apartment buildings. In total 50 state energy agencies, 52 utilities, and 201 private sector (non-utility) organizations were contacted for information. The status of utility and private sector audit services for these building types is summarized and recommendations for CACS program audits are presented.

55903 **Apparatus for closed-loop combustion control in internal combustion engines.** Cheklich, G.E. US Patent Application 6-474,087. 10 Mar 1983. 11p.

Schematically disclosed is an engine control apparatus wherein cylinder pressure is sensed before and after the top dead center position. Desired cylinder pressure curves are stored in a microcomputer for a range of engine speed-load combinations. By electrically comparing the actual pressure-time curve with the desired pressure curve for the existing speed-load combination it should be possible to generate an error signal representing deviation of actual engine performance from the desired performance, i.e., a permissible plus or minus band following the desired curve. The invention would provide a control action using only three parameters, namely engine speed, engine load and cylinder pressure.

3202 Transportation

REFER ALSO TO CITATION(S) 55948

55904 **(CONF-830847—2) Assessment of national energy-saving policies for transportation.** LaBelle, S.J.; Moses, D.O. (Argonne National Lab., IL (USA); USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC. Office of Environmental Analysis). Aug 1983. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01. Order Number DE84000585.

From Energy resource management '83; San Francisco, CA, USA (23 Aug 1983).

Two strategies for saving energy in urban transportation were tested in three cities for their impact on the environment. The impacts of these strategies were contrasted to those occurring under the extension of policies in place in 1980. Key results included increased indirect energy use by transportation towards the end of this century; lack of impact on critical materials in building new, more fuel-efficient vehicles for urban travel; the dominance of fuel price increases in achieving the substantial energy savings projected by the year 2000; the differential impacts between fast growing and stable metropolitan areas; and the projection that both emissions and energy standards for urban vehicles can be met. Substantial energy savings were projected under all conditions; 40% savings were expected in the year 2000, relative to 1980, even under policies in place in 1980. The assumed rate of fuel price increase, from 3 to 5% per year depending upon the scenario, proved to be crucial in achieving these energy savings. Increased automotive fuel economy alone could not achieve energy savings in the long run. Further savings were achieved under each of the two strategies tested: Individual Travel, which promoted more fuel efficient automobiles than expected under In-Place Policies; and Group Travel, which promoted the use of transit systems by improved service and lower fares, and discouraged the use of autos by increased fuel taxes and parking taxes. Greater energy savings were achieved under Group Travel Strategy than under Individual Travel. In general, these energy savings were achieved without great cost to the environment or to specific social groups, even though impacts did vary by group.

55905 **(CONF-830847—3) Energy-efficient automobiles for the future.** LaBelle, S.J.; Hudson, C.L. (Argonne National Lab., IL (USA); Hudson Associates, Santa Barbara, CA (USA)). Aug 1983. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01. Order Number DE84000600.

From Energy resource management '83; San Francisco, CA, USA (23 Aug 1983).

The characteristics of energy-efficient vehicles determined by the degree of incorporation of advanced technology and on reactions of consumers to the vehicles using those technologies are emphasized. Critical technology design aspects, as well as important consumer preferences, have been identified. Nearly 300 vehicles were designed using a heuristic method to meet several different expectations of consumer preference for acceleration. Air-pollutant emission standards in the Clear Air Act Amendments of 1977 were assumed to have been met in all designs, even when fuel efficiency was projected to increase sharply. Weight reductions are still expected to play an important role in improving fuel economy. Stirling, and electric motors, was also expected to play a significant role in reducing automobile energy consumption. Use of alternative fuels for spark-ignition engines, as well as for the other engines, was projected. Large gains in overall energy efficiency were projected, with methanol fuels playing a significant role. Even with so many acceptable alternatives projected to be available to households for purchase, the spark-ignition engine always captured the largest share of the market. Steady improvement in that vehicle's design kept it attractive to households through the year 2000 under varying economic conditions.

55906 **(CONF-831160—1) Concise medium for industrywide dissemination of railroad fuel-savings measures.** Saricks, C.L.; Bertram, K.M. (Argonne National Lab., IL (USA)). Mar 1983. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01. Order Number DE83015373.

From 24. annual meeting of transportation research forum; Crystal City, VA, USA (2 Nov 1983).

In order to meet the need for a concise compendium of information relating to fuel conservation in railroad freight operations, a matrix was developed which summarized a wide variety of fuel-saving measures and their associated costs and benefits. Organizational approach and technique were consistent with that applied to the earlier formulation by Argonne of a matrix for use by the maritime shipping industry. Information was derived primarily from technical sources and manufacturers' literature. This matrix was reviewed by a panel of experts from the rail industry and was revised based upon their critique. In its final form, it lists 38 fuel savings measures under seven principal headings. Special emphasis is placed on well-conceived education and training programs, improved fuel inventory control and handling, reduction of empty freight car miles, and elimination of unnecessary idling, all identified as crucial to any railroad energy cost reduction program.

55907 **(CONF-831160—2) Measuring energy use in urban travel using a sketch planning model.** Kaplan, M.; LaBelle, S.; Saricks, C. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 25p. NTIS, PC A02/MF A01. Order Number DE83015375.

From 24. annual meeting of transportation research forum; Crystal City, VA, USA (2 Nov 1983).

An innovative approach to modeling transportation energy demand in metropolitan areas was developed at Argonne National Laboratory for US DOE. A sketch planning travel-demand model (called SRGP) was joined with an auto-ownership model, a fitting technique for demographic forecasts, and an algorithm to assign origin/destination travel to the intervening districts called the Urban Transportation Policy Analysis Process (UTPAP). The central component of UTPAP is XRGP, an extended version of the computer program for the Short Range Generalized Transportation Policy Analysis (SRGP), which is a sequence of disaggregate travel-demand models that estimate aggregate travel demand through a random-sample enumeration process. The XRGP has the extended ability to input different vehicle-ownership profiles for different household types and account for travel by as many as ten vehicle types, fueled by up to seven types of fuel. Results from this analysis process are sensitive to technology characteristics, as well as to fuel price and metropolitan development patterns. Forecasts for three typical cities indicate a large potential for saving energy relying on automotive fuel-economy improvements and rising fuel prices, without detrimental effects or urban mobility. Fuel-saving potential varies by type of city, with rapidly growing metropolitan areas unlikely to stay below 1980 fuel use unless population growth occurs in more-established, transit oriented cities. Diesel-fuel use may continue to rise after 1990, depending directly on the strength of the economy and inversely on the success of competing, spark-ignition/gasoline-fueled automobiles.

55908 **(ORNL/TM—8843) Trends in heavy-truck energy use and efficiency.** Roberts, G.F.; Greene, D.L. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 73p. NTIS, PC A04/MF A01. Order Number DE84000290.

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An analysis of recent historical and projected future trends in heavy-truck [over 26,000 lbs Gross Vehicle Weight (GVW)] fuel economy and fuel consumption is presented. In-depth consideration is given to the various technological improvements which account for ongoing fuel-economy improvements in the heavy-truck fleet. Literature estimates are used to arrive at fuel-economy-improvement figures for the various technologies. Market penetrations are projected using a technological forecasting model based on the Weibull distribution. Fuel-economy improvements possible with the application of new advanced technologies are contrasted to those possible with currently available technologies only. It is estimated that these advanced technologies could account for a 20% savings, or 4.1 billion gallons of fuel per year by the year 2000. It is suggested that long-term technologies could double this savings to 8 billion or more gallons per year.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 55402, 55403, 55404, 55414, 55568, 55931, 55961

55909 **(AD-A—129504/7) Process energy inventory at Iowa Army Ammunition Plant Lines 1, 2, and 3A. Final report.** Thompson, D.W.; Hadenfeldt, G.L.; McKay, R.E.; Krajkowski, E.A. (Mason and Hanger-Silas Mason Co., Inc., Middletown, IA (USA). IAAP Development Dept.). Apr 1983. 97p. NTIS, PC A05/MF A01.

A process energy audit was conducted at Iowa Army Ammunition Plant. Lines 1, 2, and 3A were surveyed. Energy consumption baselines were established for eight production items: the Hawk, Stinger, Chaparral, Dragon, Copperhead and Improved TOW Warheads, the M549A1 RA Projectile, and the M718/M741 AT Projectile. A number of potential energy conservation projects were defined to reduce present energy use.

55910 **(BNL—33672) Industrial process models.** Pierce, B. (Brookhaven National Lab., Upton, NY (USA)). May 1983. Contract AC02-76CH00016. 27p. NTIS, PC A03/MF A01. Order Number DE84000624.

The National Center for Analysis of Energy Systems at Brookhaven National Laboratory has developed process optimization models of the U.S. pulp and paper, iron and steel, and aluminum industries. Given fuel price and product demand projections, the models project modes of operation and energy consumption characteristics that minimize the cost of meeting the expected demands over a 25-year time horizon. Each model includes energy-conserving options to conventional technologies. Examples are vapor recompression, hydropyrolysis, scrap preheating, induction reheating, and titanium diboride cathodes. Model results include fuel use by type and time period as well as use of new technologies. Users can examine the effects of fuel prices, tax policies, product demands, and alternative investment scenarios on fuel and electricity use in each industry.

55911 (BNL—51679, pp 106-132) **Economics of minerals recovery from fly ash.** Letzt, A.M. (Science Management Corp., Washington, DC). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

Several major plants designed to reclaim energy and materials from solid wastes (e.g., municipal wastes) have experienced both economic and technical failures. Therefore, it is prudent for proponents of coal ash resource recovery processes to pay attention to the lessons learned by the solid waste recovery industry: Keep the capital costs of the plant low, keep the plant design simple, each subsystem must be cost effective, and perform a realistic market survey for the by-product(s). Characterization of fly ash and x-ray diffraction experiments aimed at better understanding the reactions are crucial to successful process development. However, as these processes progress to the process development unit (PDU) or pilot plant stage, economic analyses should be used to identify major cost items and direct R and D toward cost reductions. The requirements for reagent recycle and for use of a less expensive HiChlor reductant are significant examples of cost reductions inspired by economic analyses. Preliminary economic analyses of processes designed to recover metals from fly ash indicate that at least two of the processes have economic as well as technical potential: the direct acid leach and the HiChlor processes. Further research and development will result in possible cost increases, due to scale-up, process integration and refined assumptions in addition to cost reductions due to process improvements and material or reagent substitutions. The net result is speculative. However, the driving forces behind the commercialization of these processes will include factors external to the processes such as ash disposal costs, metals supply and prices, and future strategic metals requirements.

55912 (CONF-8110292—, pp 15p, Paper 5) **Removal of dust and hazardous gas components by scrubbing.** Seeck, F. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

In order to get the optimum dust removal by the smallest feasible energy requirement differently executed venturi scrubbers are investigated. An optimum washing liquid/gas ratio of 0.7 l/m^3 is determined for the venturi tubes tested. Additionally combined systems, which were composed of from in series connected scrubber and venturi tube and from electrostatic precipitator and venturi tube are examined about their effectivity at small energy demands. The same effectivity of a venturi scrubber is obtained by the system electrostatic precipitator/venturi tube with much less energy consumption.

55913 **(DOE/CS/40033—T1) Impact assessment of the leaf protein concentrate (Pro-Xan) from alfalfa process. Draft final report.** (Hittman Associates, Inc., Columbia, MD (USA)). May 1979. Contract AC01-78CS40033. 83p. (H-C—0193/700-79-783D). NTIS, PC A05/MF A01. Order Number DE84000142.

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Wet fractionation to reduce the energy requirements of alfalfa dehydration is being examined as an alternative to the dehydration of freshly harvested alfalfa. The fractionation operation is part of an overall process to produce leaf protein concentrate (LPC) as a co-product of pelletized alfalfa. The LPC process conserves energy by mechanically grinding and then pressing out approximately half of the moisture contained in the fresh green-chop prior to dehydration, thereby allowing significant reduction of the evaporation load of the rotary dryer. The green juice extracted from the raw alfalfa at the presses is processed into LPC (also called Pro-Xan by the developers of the process) by a series of process steps including heat coagulation, curd separation and extrusion, and dehydration. Another energy conserving method now widely practiced by the alfalfa dehydrating industry involves the cutting and field drying of raw alfalfa for four to six hours prior to harvesting. In this study, three models were developed representing conventional, wilting, and LPC processing plants. These models were used to compare the potential energy use, environmental emissions, and costs involved with implementation of each process. In each model, the complete dehydration operation was examined from the harvesting of raw material to the marketing of end products.

55914 **(DOE/CS/40033—T2) Concentration processes for the beet-sugar industry.** Curran, H.M. (Hittman Associates, Inc., Columbia, MD (USA)). May 1978. Contract AC01-78CS40033. 41p. (H-C—193/200-78-730D). NTIS, PC A03/MF A01. Order Number DE84000148.

One part of the beet sugar processing plant operation, namely the juice concentration process, is presented. The concentration processes discussed could have applications in beet sugar processing plants other than juice concentration, but these are not considered. Basic energy considerations and concentration processes are discussed. The applicability of these concentration processes

are considered for electrodialysis, freezing process, vapor recompression, and reverse osmosis. Three unsolicited proposals submitted to DOE are described briefly. (MHR)

55915 **(DOE/CS/40033—T3) Analyses of industrial energy-conservation alternatives: technology impact. Final technical report.** (Hittman Associates, Inc., Columbia, MD (USA)). Jun 1979. Contract AC01-78CS40033. 38p. (H-C—0193/100-79-892F). NTIS, PC A03/MF A01. Order Number DE84000141.

The objectives and conclusions resulting from the eight technologies studied are summarized. The technologies are: concentration processes for the sugar industry, spectral fuel conservation system for low excess air combustion, high temperature recuperation for steel mill soaking pits, B.E.S.T. thermal sludge drying process for the pulp and paper industry, automatic imaging pattern recognition system for pulp fiber characterization, leaf protein concentrate extraction from alfalfa, MTI high efficiency industrial heat pump system, and hot slab inspection systems for steel mills.

55916 **(DOE/CS/40033—T4) Impact assessment of the B.E.S.T. thermal sludge drying process in the pulp and paper industry. Draft final report.** (Hittman Associates, Inc., Columbia, MD (USA)). 4 Dec 1978. Contract AC01-78CS40033. 118p. (H-C—193/500-78-755FD). NTIS, PC A06/MF A01. Order Number DE84000147.

The Basic Extractive Sludge Treatment (B.E.S.T.) drying process is being examined as an energy-saving alternative to flash drying of partially dewatered sludge produced by wastewater treatment in the pulp and paper industry. The B.E.S.T. process relies on the low 133 Btu/lb heat of vaporization of the solvent triethylamine (TEA), and on the action of TEA as a sludge conditioning agent in mechanical dewatering, to produce almost completely dry solids from input sludges of 6 to 30% solids. The dried solids may be sold as fertilizer (e.g., 7% Nitrogen, 3% P_2O_5) or burned to raise steam (e.g., 9500 Btu/lb volatiles, 20% ash). In this study, costs and energy usage were developed for sludge disposal process trajectories used or potentially used in the pulp and paper industry. Evaluations were performed on trajectories, or series of processes, in order to establish common grounds for comparisons, such as similar starting and finishing points in sludge treatment. The amount of sludge of the type which might require a thermal drying process was projected through the end of the century. Costs and energy usage for complete disposal process trajectories were compared assuming 100% saturation of the estimated market. A preliminary toxicity analysis was performed on the TEA solvent used in the B.E.S.T. process.

55917 **(DOE/NBM—4000827) Industrial case studies in cogeneration, waste-heat recovery, and fuel switching. Final report.** (Missouri Dept. of Natural Resources, Jefferson City (USA). Div. of Energy). Aug 1980. 66p. NTIS, PC A04/MF A01. Order Number DE84000827.

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Case studies in cogeneration, waste heat recovery, and fuel switching were initiated under contract to the Missouri Department of Natural Resources, Division of Energy. The purpose of these case studies is to demonstrate economic, regulatory, energy, and other impacts which industry can expect to face when it installs these emerging technologies. Each case study was based on an existing industrial facility in Missouri. Plants were visited and energy managers and other plant personnel shared their concerns about rising energy costs and what might be done in their plant. Each plant was studied to identify its energy uses and the alternatives available to it. Initially, a mail survey of industries in Missouri was used to identify major energy users with high potential for energy conservation or new technology application. From the 60 or so industries surveyed, six were selected for case studies based on potential for energy resource conservation, distribution of industry types and sizes, the type of energy technology potentially applicable, and the willingness of management to cooperate in a state-sponsored study. Two industries were selected in each category: cogeneration, waste heat recovery, and alternative fuels use or fuel switching.

55918 **(ESC—25) Installations running on fuel in the Dutch industry. A quantitative survey.** van Wees, F.G.H. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). May 1983. 170p. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770394.

Within the industrial sector in the Netherlands about 41.000 MWth of fuel-consumption capacity is installed. This figure is one of the results of an analysis of installations with direct consumption of fuel, which are contained in the database of the Emission Registration. Besides the determination of this capacity figure, the report presents information about the number and capacity of twelve different kinds of installations. These data are specified by capacity class and by fuel type. In the detailed appendix the results are given for the different industrial sections. Moreover by using the hours of operation and the rate of utilization, aggregated results about fuel consumption from each kind of installation are derived. Details are made accessible in the appendix. To the appendix a set of documentation, containing the relevant information about each industrial sector, is added.

55919 **(N—8323375) Process development for the recycling of waste and by-products containing cadmium. Final Report, Apr. 1981.** Hanusch, K. (Preussag A.G. Metall, Goslar (Germany, F.R.)). Dec 1982. 37p. (In serveral languages). (BMFT-FB-T—82-217; ISSN—0340-7608). NTIS, PC A03/MF A01.

The development of a process for the treatment of pigment waste containing Cd and Se was investigated. The following multistage recoveries are applied: (1) oxidizing leaching of the pigment wastes in sulphuric acid, in the presence of Fe3+ ions (2) precipitation of cadmium by cementation with zinc dust (3) roasting of the residues from the leaching stage, enriched in Se (4) leaching of the roasted product and precipitation of selenium. It is found that more than 90% of he Cd input could be brought into solution. A model computation with a view to integrating the pigment leaching into the Cd recovery process of a Preussag smelter is conducted.

55920 **(N—8323376) Development of a process for electrolytic recovery of metals from diluted waste water. Final Report, Aug. 1980.** Lieber, H.W. (Goetzelmann K.G., Stuttgart (Germany, F.R.)). Dec 1982. 57p. (In serveral languages). (BMFT-FB-T—82-224; ISSN—0340-7608). NTIS, PC A04/MF A01.

The electrolytic recovery of metals from waste water instead of producing metal containing sludges to be dumped was examined. Many electrolytic processes are developed for electrolytic recovery of nobel metals from diluted solutions. Conditions for deposition of electronegative metals from waste water, however, are different from processes like electroplating or electrolytic metal refining. It is shown that metal deposition down to very small concentrations within the ppm range can be obtained with lower electrolytic currents by a forced flow of waste water through a rotating particulate bed cathode whereas for higher currents impact rod cathodes have proven more successfully. Residual metal ions can be completely removed from waste water by ion exchange resins. This new process is tested using waste water which mainly contains nickel, cadmium and zinc.

55921 **(N—8323697) Assessment of critical-fluid extractions in the process industries. Final Report.** (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1982. 40p. (NASA-CR—170243; JPL—9950-793). NTIS, PC A03/MF A01.

The potential for critical-fluid extraction as a separation process for improving the productive use of energy in the process industries is assessed. Critical-fluid extraction involves the use of fluids, normally gaseous at ambient conditions, as extraction solvents at temperatures and pressures around the critical point. Equilibrium and kinetic properties in this regime are very favorable for solvent applications, and generally allow major reductions in the energy requirements for separating and purifying chemical component of a mixture.

55922 **(ORNL/Sub—80-28906/2) Demonstration of a low-temperature waste-heat-driven refrigeration system. Phase III. Final report.** Borhanian, H.; Hynek, S. (Foster-Miller Associates, Inc., Waltham, MA (USA)). Sep 1983. Contract W-7405-ENG-26. 166p. NTIS, PC A08/MF A01. Order Number DE84000303.

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As the cost of energy continues to rise faster than the cost of machinery, the minimum temperature for economically recoverable waste heat continues to decrease. The Department of Energy, anticipating the day when 140°F water will constitute an economically exploitable resource, has funded the development of several systems to convert 140°F water into process steam or industrial refrigeration. One such system that is powered by the 140°F water and delivers 20 tons of refrigeration was designed, built, and tested. This system uses an organic Rankine power cycle to drive a standard vapor-compression refrigeration cycle. The power and refrigeration cycles are integrated in that they share a common working fluid (R-22), a common condenser, and a single hermetic housing for all moving parts. The measured performance of the system and its components are described and the reasons for and results of those design refinements are discussed.

55923 **(PB—83-216788) High-temperature ceramic recuperator and combustion air burner programs. Semi-annual report Apr-Oct 81.** Coombs, M.; Kotchick, D.; Strumpf, H. (AiResearch Mfg. Co., Torrance, CA (USA)). Nov 1981. 215p. NTIS, PC A10/MF A01.

The report covers the Phase I studies conducted by AiResearch and its principal subcontractor, the Bloom Engineering Company, on the GRI high-temperature ceramic recuperator and high-temperature preheated combustion air burner system programs. The objectives of the Phase I studies of these programs were to (1) review the current state-of-the-art in high-temperature preheat burners and ceramic recuperators; (2) assess the market potential for an 1800 to 2000 F preheat combustion air system; (3) evaluate the application of such systems to selected industrial processes, and (4) develop a preliminary design for a ceramic recuperator and burner for a specific industrial host-site. The host site preliminary design will then be utilized as a reference for the Phase II component development efforts.

55924 **(PB—83-228429) Open-cycle vapor compression heat pump. Annual technical report Jan-Dec 82.** Becker, F.E.; Ruggles, A.E. (Thermo Electron Corp., Waltham, MA (USA)). Apr 1983. 71p. (TE—4224-71-83). NTIS, PC A04/MF A01.

Large quantities of low-grade energy are wasted by industry in the form of low-preasure steam and low-temperature heat. The practical and economical recovery of energy from these sources is restricted by the limited number of useful applications for low-grade energy, and is further complicated by contamination of the waste streams. Thermo Electron has developed an open-cycle steam heat pump system capable of the direct recovery and upgrading of low-grade waste steam. The system compresses low-pressure waste steam (or steam made from sources of low-temperature waste heat) to produce high-pressure steam suitable for use in industrial processes.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 55569, 55570, 55876, 55878, 55931

55925 **(AD-A—129245/7) Environmental assessment of a central heating plant. Final report Sep 82-Jan 83.** Sawyer, K.I. (Engineering-Science, Inc., Fairfax, VA (USA)). Feb 1983. 134p. NTIS, PC A07/MF A01.

The purpose of this report is to identify the anticipated environmental effects which could be expected in a Central Heating Plant Conversion T K.I, Sawyer. These effects will determine whether an Environmental Impact Statement is required.

55926 **(DOE/RG/10256—T1) Innovative Rates Program. Final report.** (City Utilities of Springfield, MO (USA)). 21 Jun 1982. Contract FC01-79RG10256. 50p. NTIS MF A01. Order Number DE83017922.

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Title II of the Energy Conservation and Production Act (ECPA) as amended by the Public Utility Regulatory Policies Act (PURPA) provided financial assistance to state utility regulatory commissions, nonregulated electric utilities, and the Tennessee Valley Authority through the Innovative Rates Program. The financial assistance was to be used to plan or carry out electric utility regulatory rate reform initiatives relating to innovative rate structures that encourage conservation of energy, electric utility efficiency and reduced costs, and equitable rates to consumers. The Federal and local objectives of the project are described. Activities planned and accomplishments are summarized for the following: project management, data collection, utility bill evaluation, billing enclosure/mailing evaluation, media program evaluation, display evaluation, rate study sessions evaluation, speakers bureau evaluation, and individual customer contacts. A timetable/milestone chart and financial information are included. (MHR)

55927 **(INIS-mf—8197) 25 years of KWS. 25 years in the service of education.** (Kraftwerksschule e.V., Essen (Germany, F.R.)). 1982. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780013.

Since the first course of instruction twenty-five years ago 2085 foremen of power plants and district heating systems have by now received their certificates of a Chamber of Commerce and Industry. They are acting as unit operators and shift foremen and enjoy esteem and respect in their plants. Moreover, 3232 power plant operators have meanwhile finished their education and received the certificates for power plant operators from the 'KRAFTWERKSSCHULE E.V.' (power plant school). Power plant foremen and operators have proved in practice; their education will also in future be an essential part of the acitvities of the 'Kraftwerksschule e.V.'. With the peaceful utilization of nuclear energy new tasks have arisen to the 'Kraftwerksschule e.V.' They satisfied this development and and are since 1969 also educating nuclear power plant foremen. As the profound training in nuclear reactors themselves is only possible with a lot of reservations, the 'Kraftwerksschule e.V.' began in 1974 to build a nuclear power plant simulator center. One simulator each for nuclear power plants with pressurized water reactors and boiling water reactors have been available for four years. Operators of nuclear power plants who already have profound theoretical and practical knowledge are by this means receiving a complementary education on the dynamic operation behaviour of the plant and they learn to judge operating orders and to control the process with a high degree of safety and availability by means of performance-directed control measures. The good experiences made since 1978 with the use of simulators in the nuclear education have led to the decision to build in addition a simulator for fossil-fired power plants. Late in 1981 the orders for delivery of the simulator hardware and software were placed. The simulator will be available for primary and advanced training by the end of 1984. (orig./GL).

3209 Education And Public Relations

55928 **(DOE/IR/10037—T1) Module two: energy utilization.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 30p. NTIS, PC A03/MF A01. Order Number DE84000230.

This report contains a teaching module for presentation at the junior college level. A shortened version can also be presented to civic groups or high school vocational classes. Energy use in the past is contrasted with present energy use in 3 sectors: business, industry and the home. The module explains specifically the changes in energy sources and outlines energy use, the need for, and methods of conservation of energy in these 3 sections. 29 references, 7 figures. (DMC)

55929 **(DOE/IR/10037—T2) Module three: transportation.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 20p. NTIS, PC A02/MF A01. Order Number DE84000231.

A historic overview is given of transportation from the primitive modes to the modern. The interrelationship of advancements in transportation to technological growth is shown.

55930 **(DOE/IR/10037—T3) Module four: building construction.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 42p. NTIS, PC A03/MF A01. Order Number DE84000232.

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The following are included: information on materials and sizing of ductwork, selection of insulation, including duct insulation, attic and wall insulation, weatherstripping, window placement and selection of glass, door locations, building orientation, and selection of surface treatments for reflection or absorption. (MHR)

55931 **(DOE/IR/10037—T4) Module five: energy conservation by recycling.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 40p. NTIS, PC A03/MF A01. Order Number DE84000233.

The value of recycling, reusing, and reclaiming natural and man-made materials is shown as a source of energy as well as resource conservation. Bio-fuels, including agricultural and wood products, glass, steel, aluminum, and other metals and materials are discussed for their recycling, reuse, and reclamation value. The cost of gathering, sorting, and processing reusable materials and some of the problems and legislation involved are discussed. (MHR)

55932 **(DOE/IR/10037—T5) Module six: alternate energy sources.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 53p. NTIS, PC A04/MF A01. Order Number DE84000234.

This module is designed to give the student an overview of current research and development in the following areas of alternate energy: solar, wind, oceanic, biomass conversion, geothermal, nuclear and others. A discussion of the current cost feasibility and potential impact of these solutions is included where possible. A teaching guide is included.

55933 **(DOE/IR/10037—T9) Module ten: citizen's role in conserving energy.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 16p. NTIS, PC A02/MF A01. Order Number DE84000152.

This module reviews the use of energy in all forms by the average citizen, and through the use of charts shows how the individual citizen relates to the overall consumption of energy. The module also presents the role that the citizen should play in the future and attempts to show what the future holds for the consumer if he does not properly manage energy use now. A teaching guide is included.

55934 **(DOE/IR/10037—T10) Module one: energy for survival: an overview.** (Brevard Community Coll., Cocoa, FL (USA). Energy and Energy Conservation Workshop for High School Faculty). 1980. Contract FG05-79IR10037. 16p. NTIS, PC A02/MF A01. Order Number DE84000179.

This report contains a teaching module for presentation at the junior college level. The purpose is to show where energy comes from and, in selected cases, how the supply of fossil fuels is not only limited at the moment, but has a reasonably predictable exhaustion period. Students should be made aware of the many energy demands which we all make as a result of our present life styles. The relationship between energy and ecology is also addressed. 26 references, 5 figures. (DMC)

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 55905

55935 **(DOE/CS/54266—3) Alternative fuels for medium-speed diesel engines (AFFMSED) project: slurries, emulsions and blended-fuel extenders; cylinder wear measurements, staged injection. Third research phase final report.** Baker, Q.A. Jr.; Wakenell, J.F.; Ariga, S. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1983. Contract AC01-78CS54266. 186p. (SWRI—5361-003). NTIS, PC A09/MF A01. Order Number DE84000524.

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The third year of research activity on an ongoing research, development and demonstration effort to investigate the use of alternative fuels for medium-speed engines is described. Tests were performed using laboratory medium-speed diesel engines to define the ability of these engines to operate on alternative fuels, the fuel property limits that the engines can tolerate, the problems associated with alternative fuels use, and methods to improve fuel tolerance and to overcome the problems identified. The fuels studied during the Phase III program were alcohol-in-diesel fuel emulsions, water-in-diesel fuel emulsions, sunflower oil/diesel fuel blends, No. 6 fuel oil/diesel fuel blends, and a carbon black/diesel fuel slurry. Also studied were methods to measure cylinder liner and piston ring wear rates in a short period of engine operation. Finally, staged injection was investigated as a means to improve engine performance on low cetane number fuels.

55936 **(NP—3770384) High temperature ceramics for automobile gas turbines.** Walzer, P. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 23 Jun 1981. 109p. (In German). NTIS (US Sales Only). Order Number DE83770384.

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The thesis is divided in three parts. In the first part a ceramic automobile turbine with a turbine entry temperature of 1623 K is designed as a drive for a passenger car of the upper middle car class. Properties of this drive are projected and thus compared with regard to the essential evaluation criteria of conventional drives: driving performance fuel consumption and emission of pollutants. Production methods and properties of various ceramic materials are discussed in the second part. The production design of ceramic components is explained by using wheel and compressor turbine as an example. The third part describes todays state of development of ceramic components and lists the points where further work is needed.

55937 **(NP—3770391) Calculation of secondary piston movement in combustion engines.** Tschoeke, H.E. (Stuttgart Univ. (Germany, F.R.). Fakultaet Energietechnik). 19 Nov 1981. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83770391.

Portions are illegible in microfiche products; Thesis.

Increasing stress on components - for example when engines are supercharged - and the successful reduction of the sofar major sources of noise of a combustion engine are the reasons, why mechanical noises - caused for instance by the piston and the cylinder walls - are becoming a main point of interest with regard to noise reduction. The movement model which is used in this thesis to calculate the secondary piston movement and the slap movement is the first to take a close-to-reality curved piston skirt profile, all friction surfaces on piston and rod and mass distribution of piston and rod into account. The crossing of the crank mechanism by shaft- or cylinder offset and/or piston pin offset is investigated systematically. Investigation of further piston-, engine- and operational parameters permits to documentate relations so far only known by experiments and to evaluate the parameters with regard to their influence on piston noise.

55938 **(NP—3770392) Investigation of load control in otto-engines.** Hockel, K.G.L. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 28 Jun 1982. 171p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770392.

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Subject was tackled with the following methodical steps: 1. setting up a computer program for real process computing of an Otto engine and getting all necessary output data for an analysis of the efficiency degree. Special importance is attributed to - exact computation to conditions in the lower speed and load range - analytical representation of dependencies between combustion process and friction; and 2. investigaton of different load control methods by means of simulation computing, in individual cases by measuring; the usual throttle control of the Otto engine is used as a basis and analysed in detail.

55939 **(PNL—4568) Efficiency evaluation of the direct-injection stratified charge (DISC), dilute homogeneous charge (DHC), and direct-injection diesel (DI Diesel) engines.** Hane, G.J. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 61p. NTIS, PC A04/MF A01. Order Number DE83017910.

The thermodynamic laws governing the Otto and diesel cycle engines and the possible approaches that might be taken to increase the delivered efficiency of the reciprocating piston engine are discussed. The generic aspects of current research are discussed and typical links between research and the technical barriers to the engines' development are shown. The advanced engines are discussed individually. After a brief description of each engine and its advantages, the major technical barriers to their development are discussed. Also included for each engine is a discussion of examples of the linkages between these barriers and current combustion and thermodynamic research. For each engine a list of questions is presented that have yet to be resolved and could not be resolved within the scope of this study. These questions partially indicate the limit to the state of knowledge regarding efficiency characteristics of the advanced engine concepts. The major technical barriers to each of the engines and their ranges of efficiency improvement are summarized.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 55905

55940 **(DOE/CS/50122—T1) DOE Electric-Car Evaluation Project. Final report.** Goldberg, S. (California Polytechnic State Univ., San Luis Obispo (USA). Dept. of Electronic and Electrical Engineering). [nd]. Contract FG01-79CS50122. 8p. NTIS, PC A02/MF A01. Order Number DE83016774.

A study was carried out to evaluate the operating characteristics of an electric car when used as an errand vehicle and short distance commuter car. The car performed satisfactorily when the road surface was smooth and even. The car's performance was judged as unacceptable on hilly or rough roads. A number of recommendations are given, primarily, the car is underpowered and lacks a suitable manual gear shift. In addition to evaluating the car's performance, an attempt was made to publicize the use of electric cars in general and the DOE Demonstration program. Some newspaper coverage was obtained and the car was displayed at Poly Royal which is an annual open house held at Cal Poly each year. It is estimated that over 100,000 people attended the 1982 Poly Royal and many of those attending saw the car and learned about the DOE Electric Car Program. A number of Electrical Engineering students worked closely with the car and at least three of them carried out their senior project in conjunction with it. These projects give the engineering student the opportunity of designing and building a practical project of their own choice. The projects were, an AC inverter, a solid state motor controller and a digital display ampere-hour meter.

55941 **(DOE/NASA/51044—32) Steady-state and dynamic evaluation of the electric-propulsion system test-bed vehicle on a road load simulator.** Dustin, M.O. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Aug 1983. Contract AI01-77CS51044. 19p. (NASA-TM—83445). NTIS, PC A02/MF A01. Order Number DE84000606.

The propulsion system from the electric propulsion system test bed vehicle was evaluated on the road load simulator (RLS). Track tests had previously been conducted. The electric vehicle was built from components representative of 1976 technology, including a series-wound dc motor and a commercially avaible silicon-controlled rectifier (SCR) chopper type of controller. An 84-V battery pack was used with the system in the vehicle. A large motor-generator battery simulator was used in all of the RLS tests. Steady-state tests were conducted over a wide range of differential outputs and vehicle speeds. Efficiencies of the system and of the individual components were mapped. The maximum system efficiency measured was 67 percent at 64-km/h (40-mph) vehicle speed and 113-N-m (1000-lb-in) differential torque. The effects of motor temperature on motor efficiency and of battery voltage on motor and controller efficiencies were evaluated. Dynamic tests were also conducted on the system by running it over the SAE J227a B and C driving schedules. The energy efficiency over schedule B was 55 percent; that over schedule C was 58 percent. Over schedule B the total energy taken from the battery was 155 Wh/km (249 Wh/mile). Over schedule C, 178 Wh/km (287 Wh/mile) was removed from the battery.

55942 **(NP—3770389) Calculations and optimization of direct-current drives for electric powered vehicles.** Heldt, J.J. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 14 Jul 1981. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770389.

Thesis.

This thesis deals with optimum design of d.-c. drives for electric-powered vehicles. Based on a lead battery a calculation method is developed for a drive configuration consisting of: energy storage unit, actuator and traction motor. The calculation method takes a non-linear operation of the energy storage unit into account and also contains the design algorithm for the traction engine. A strategy of optimization overlays the planning- and simulation program. Drives for vehicles with a total vehicle mass between 2 to 24 tons are optimized. The motor plan obtain through computation is applied to a small transporter and investigated by means of experiments. The optimised drive of this vehicle is compared to another drive which could also be used for the same vehicle in order to demonstrate the improvement of the cruising range. Finally ways are indicated which promise further benefits for range.

55943 **The role of computer modeling and simulation in electric and hybrid vehicle research and development.** Wolfson, R.P.; Gower, J.H. (Aerospace Corp., 955 L'EnFant Plaza, Washington, DC 20024). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Vehicular Technology;* **32**: No. 1, 62-73(Feb 1983).

Computer modeling and simulation is widely used in support of electric and hybrid vehicle research and development. Many modeling-assisted studies and assessments, involving candidate technology comparisons, have been performed to provide information for management planning and research decisions. Modeling has also been extensively used in engineering activities including preliminary and final design optimization. A wide range of programs has been developed including small ones for use on hand-held programmable calculators and large programs involving more than 11 000 lines. Many programs exist in the public domain, and two major programs are available on commercial time-sharing systems.

55944 **Electric vehicle test and evaluation program: site operators' experience.** Yanni, L.A. Jr. (General Electric Company, Crystal Gateway One, 1235 Jefferson Davis Highway, Arlington, VA 22202). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Vehicular Technology;* **32**: No. 1, 74-80(Feb 1983).

A total of 35 private companies and federal, state, and local agencies are currently participating in the Department of Energy's Electric Vehicle Test and Evaluation Program. These participants are operating, in aggregate, 712 electric vehicles in 22 states and the District of Columbia, and reporting monthly to the Department of Energy (DOE) on their operating and maintenance experience with the vehicles. When the program closes in 1985, an estimated 25 000 vehicle-months of data will have been collected. At this time, approximately 6000 vehicle-months of data have been collected since the program's first fully operational fleet was put into service in January 1980. The data show that battery reliability and maintenance constitute a significant problem in the vehicles now in operation.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 55943

55945 **A summary of EHV propulsion technology.** Schwartz, H.J. (NASA Lewis Research Center, Mail Stop 500-214, 21000 Brookpark Rd, Cleveland, OH 44135). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Vehicular Technology;* **32**: No. 1, 3-6(Feb 1983).

The quest for a commercially successful electric vehicle invariably centers around three major factors which influence buyer decisions: performance, range, and cost. Using today's technology, two items within an electric vehicle have the greatest influence on these factors. The battery is the primary determinant of range and to a lesser extent of performance. The design of the propulsion system sets the performance level of the vehicle and has a smaller effect on range. While the battery has the greatest impact on the life cycle cost of a vehicle, the propulsion system is a much larger contributor to the purchase price. Propulsion subsystem weight, efficiency, and cost are related to the specified combination of components used. Under the United States Department of Energy's Electric and Hybrid Vehicle Program, propulsion component and system advancements have been made which will result in weight savings of 35-50 percent, efficiency gains of 25 percentage points, and significantly lower cost when compared to the state of the art at the inception of the program.

55946 **EHV systems technology - a look at the principles and current status.** Kurtz, D.W.; Levin, R.R. (Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Vehicular Technology;* **32**: No. 1, 42-50(Feb 1983).

Systems analysis provides a crucial focal point which binds together the various component and subsystem technologies in electric and hybrid vehicle (EHV) development. Basic principles and practices involved in system engineering are examined in order to define this sometimes nebulous concept better. Recent electric vehicle (EV) system developments are reviewed with some emphasis on their fundamental limitations. Hybrid-electric vehicles (HV's) are introduced as an alternative which overcomes many of these limitations. A hybrid concept assessment methodology is presented which utilizes the state of the technology and yet satisfies Department of Energy (DOE) petroleum displacement goals.

3305 Flywheel Propulsion

55947 **(DOE/ET/26306—1) Assessment of flywheel-system benefits in selected-vehicle applications.** Forrest, L.; Kubo, L.H. (Aerospace Corp., El Segundo, CA (USA). Eastern Technical Div.). Oct 1981. Contract AC08-79ET26306. 288p. NTIS, PC A13/MF A01 . Order Number DE84000034.

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A study was made of the performance characteristics of vehicle systems incorporating energy storage flywheels. The study focused on two specific automotive applications in which the capabilities of flywheel-equipped vehicles were compared to their non-flywheel counterparts: (1) an intermediate-class passenger car/urban taxi with conventional internal combustion engine (ICE) drive (fuel conservation application of the flywheel system), and (2) a subcompact-class commuter car with electric drive (range extension application of the flywheel system). The intermediate-class vehicle was examined in both series and parallel drivetrain configurations. In the series configuration drivetrain, the flywheel effectively drives the vehicle while the engine operates in an on-off mode to maintain flywheel speed. In the parallel configuration drive-train, the engine drives the vehicle in a conventional manner, while the flywheel operates to augment the engine power output as needed to meet road load. The drivetrain examined for the subcompact vehicle incorporates a battery-powered dc traction motor and a hermetically sealed flywheel-motor/generator unit that outputs electrical energy to augment the battery source. The performance characteristics of these flywheel vehicle systems were analyzed using a computer-based vehicle simulation program (HYFLY). The performance figure-of-merit employed in the analysis of the heat engine/flywheel vehicles was fuel economy benefit (percent fuel economy improvement over baseline vehicle), and that for the battery/flywheel vehicle was range extension benefit (percent range improvement over baseline vehicle). The fuel economy parameter was evaluated for taxi, urban, highway, and composite driving conditions, and the range parameter was evaluated principally for the J227a(D) driving schedule.

3306 Vehicle Design Factors

55948 **(DOE/ER/10948—T1) Study of the contained air flow in a radial tire: experimental. Final report.** Skinner, G.T.; Rae, W.J. (Arvin Calspan, Buffalo, NY (USA). Applied Technology Group). Apr 1983. Contract AC02-81ER10948. 41p. NTIS, PC A03/MF A01. Order Number DE84000840.

The experimental phase of a DOE-sponsored program investigating the internal air flow in a 14" radial tire running under load at roadway speed is described. The experimental apparatus used to obtain velocity profiles is described. An extensive data base was obtained and is presented. Radial traverses were made midway between the sidewalls (radial centerplane) and at stations displaced two inches towards both the inner and outer sidewalls. These traverses were made at the center of the footprint and at various angles of rotation ahead of and folowing the footprints. For selected cases two traverses were made, one with the anemometer probe pointing in the direction of rotation, and one with the probe reversed, so as to allow the direction of the mean velocity to be determined in the areas with high turbulence levels. In all, about 30 traverses were completed, with data obtained at radial intervals from 0.1 to 0.25 inch. For each data point, 100 measurements of the velocity components, obtained with a three-component digital hot-wire anemometer, were taken. The average and rms components were then computed. The traverses extended from the rim to within about 0.25 inch from the carcass as the probe passed through the footprint area. The data provide a very clear picture of the flow field configuration as the air in the cavity passes through the footprint region.

3307 Emission Control

55949 **(ANL/ES—133) Effects of relaxing automobile emission standards: a generic analysis and an urban case study.** Saricks, C.L.; Singh, M.K.; LaBelle, S.J.; Novak, K.M.; Rowe, M.D. (Argonne National Lab., IL (USA)). Jan 1983. Contract W-31-109-ENG-38. 145p. NTIS, PC A07/MF A01. Order Number DE84000193.

Policy impact modeling procedures were used to assess the effects of relaxing automotive emission standards for carbon monoxide (CO) and nitrogen oxides (NO/sub x/) through 1986 to those levels in effect for 1980 model-year automobiles. These effects were compared with those resulting from retention of the current, more-stringent emission standards with respect to automobile characterization (the effect of emission control equipment on vehicle cost and performance), distribution of automobile stock and sales by size class and technology, urban travel demand, and total energy consumption. A specific metropolitan area was further analyzed to estimate total vehicle emissions, project average ambient concentrations of NO/sub x/, and examine the NO/sub x/-related health ef-

fects resulting from the relaxation of emission standards. Among the principal findings of the assessment was the identification of a powerful latent market for cost-competitive vehicles with lower operating costs than comparable gasoline- or diesel-powered cars but only slightly inferior performance. The potential availability of such vehicles in the near future increases the likelihood of a continuing reduction in petroleum-fuel-related vehicular emission, although such a reduction was not explicitly credited in the analysis. The NO/sub x/ analysis showed that NO/sub x/ concentrations harmful to health generally occurred only in houses with gas stoves or in the interiors of vehicles in dense traffic. Retention of the current NO/sub x/ standards could produce an 18% decrease in health effects for vehicle occupants.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 55574

55950 **(NP—3770387) Use of liquefied petroleum gas in automobiles.** Berrens, J. (Opel (A.) A.G., Ruesselsheim (Germany, F.R.)). 1982. 21p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770387.

The pamphlet informs on the use of liquified petroleum gas as an alternative fuel in automobiles. In particular, the following issues are dealt with: 1. Composition and production of liquefied petroleum gas, 2. Advantages and disadvantages of using liquefied petroleum gas in automobiles, 3. Exhaust gas, safety aspects, filling, 4. Tolerance and possible health hazards, 5. Service stations.

36 MATERIALS

REFER ALSO TO CITATION(S) 56686

55951 **(INIS-BR—39) Development of engineering and materials science in Pronuclear: retrospective and perspectives for the 80's.** Haydt, H.M. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1982. 14p. (In Portuguese). (CONF-821248—20). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780017.

From 5. Brazilian congress on materials science and engineering; Porto Alegre, Brazil (13 Dec 1982).

The evolution of a great number of persons that completed engineering and materials science course, up to 1981, is showed. The Pronuclear, an organ that finances the personel education with emphasis in nuclear engineering, is described. (E.G.).

55952 **(NP—3770383) Research sector materials and construction types.** (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1982. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83770383.

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Research and development (R and D) of the research sector are oriented on two basic demands of aircraft construction: extreme light weight construction; highly efficient power units, supplemented by technologically relevant problems from energy technology and space travel. The five institutes of this research sector work on this field on sequential work sections.

55953 **(UCRL—15553) Material model library for explicit numerical codes.** Hofmann, R.; Dial, B.W. (Lawrence Livermore National Lab., CA (USA)). Aug 1982. Contract W-7405-ENG-48. 167p. NTIS, PC A08/MF A01. Order Number DE84000173.

A material model logic structure has been developed which is useful for most explicit finite-difference and explicit finite-element Lagrange computer codes. This structure has been implemented and tested in the STEALTH codes to provide an example for researchers who wish to implement it in generically similar codes. In parallel with these models, material parameter libraries have been created for the implemented models for materials which are often needed in DoD applications.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 55349, 55358, 55359, 55365, 55384, 55531, 55564, 55567, 55622, 55622, 55805, 55810, 56099, 56115, 56203, 56688, 56745

55954 **(AD-A—127820/9) General purpose residual stress analyzer. Final report.** Gazzara, C.P. (Army Materials and Mechanics Research Center, Watertown, MA (USA)). Jan 1983. 29p. (AMMRC-TR—83-4). NTIS, PC A03/MF A01.

An X-ray diffraction system (Rigaku Strainflex) for measuring residual stresses in both the laboratory and in the field, utilizing the same X-ray head, has been evaluated for Army applications. Procedures have been developed with assorted Army materiel for determining the residual stress levels in steel, aluminum, and uranium alloys. Standard calibration samples of steel and aluminum have been fabricated and tested for ensuring the accuracy of measurement on systems in the future. Recommendations have been made for improved X-ray devices to meet Army needs. This work was performed on a project under the same title, as part of the U.S. Army Materials Testing Technology Program at the Army Materials and Mechanics Research Center.

55955 **(AERE-R—10574) Assessment using thin layer activation of a corrosion inhibitor treatment.** Asher, J.; Webb, J.W.; Wilkins, N.J.M.; Lawrence, P.F. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.; UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Aug 1982. 13p. HMSO, London, price Pound2.00.

Thin layer activation has been used to measure the progress of aqueous corrosion in a chiller plant circuit at the Rutherford Appleton Laboratory before, during and after a chemical corrosion inhibitor treatment. A steady rate of corrosion of about 0.25 μm/day was reduced by over an order of magnitude by the treatment. Comparison with standard coupon weight loss measurements was also made and revealed systematic differences attributed to edge effects on the coupon.

55956 **(AGARD-R—705) Application of fracture mechanics to the growth of creep cracks.** van Leeuwen, H.P. (National Aerospace Lab., Amsterdam (Netherlands)). Jun 1983. 160p. NTIS, PC A08/MF A01.

The behavior of materials at elevated temperatures is of crucial interest to both engine designers and operators, and there is a need for a base on which to build an approach to damage tolerant design. This paper discusses the literature relating the application of fracture mechanics to the growth of creep cracks, and shows that the linear elastic approach has been applied successfully to topics such as the residual strength of brittle materials, and crack growth due to stress corrosion and to fatigue; the difficulties in accounting for plastic behavior are considered. A survey is made of attempts to correlate crack growth rate under creep conditions with various parameters; alternative methods of calculating the contour integrals J and J* are reviewed. A survey of theoretical crack growth rates, as functions of parameters which are considered to be determining, is also included. The paper ends with a discussion and some conclusions. 90 references, 29 figures, 5 tables.

55957 **(BNL—33600) Superconducting properties of Nb_3Sn multifilamentary wires fabricated by internal tin process.** Higuchi, N.; Tsuchiya, K.; Klamut, C.J.; Suenaga, M. (Brookhaven National Lab., Upton, NY (USA); Electrotechnical Lab., Ibaraki (Japan); National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). 1983. Contract AC02-76CH00016. 8p. (CONF-830841—24). NTIS, PC A02/MF A01. Order Number DE83018189.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

The heat treatments were divided into prerection and reaction-treatments. The main microstructural difference in the two heat treatments lie in the amounts of the large Kirkendal's voids. The grain size increased at the higher temperatures. The superconducting critical temperature and current density were measured. It is believed that a current density of ≧ 1200 A/mm² can be

achieved if the filament size and heat treatment can be optimized. (DLC)

55958 **(BNL—33601) Relationship between the martensitic phase transition and the superconducting properties of A15 compounds.** Welch, D.O. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 12p. (CONF-830841—23). NTIS, PC A02/MF A01. Order Number DE83018186.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

It has been suggested that inhibiting the martensitic phase transition is a possible means of improving the H/sub c2/ of Nb_3Sn. This paper contains a discussion of the current theoretical ideas on the relation between the martensitic and superconducting transitions in A15 compounds and a review of the experimental evidence on the effect of pressure, alloying additions, and radiation-induced disorder on the coupled transitions as well as the related tetragonal-strain dependence of the superconducting properties. 36 references, 7 figures.

55959 **(BNL—33604) Density of occupied d states in transition metal-metalloid metallic glasses.** Pease, D.M.; Hayes, G.H.; Choi, M.; Budnick, J.I.; Hines, W.A.; Hasegawa, R.; Heald, S.M. (Connecticut Univ., Storrs (USA); Allied Corp., Morristown, NJ (USA); Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 6p. (CONF-830888—9). NTIS, PC A02/MF A01. Order Number DE84001206.

From 5. international conference on liquid and amorphous metals; Los Angeles, CA, USA (15 Aug 1983).

New data on the x-ray absorption edge near-in structure of the $Ni_{0.50}Pt_{0.50})_{75}P_{25}$ system is compared with previous results on random solid solution alloys and other TM-M metallic glasses. Whereas experimental probes of the density of d states at the Fermi energy, rho/sub d/(E/sub f/), often indicate a sharp reduction in rho/sub d/(E/sub f/) due to the presence of metalloids or nontransition metals, absorption edge results usually indicate a negligible decrease in the total number of d holes per transition metal atom. In the $(Ni_{0.50}Pt_{0.50})_{75}P_{25}$ system the number of 5d holes per Pt site is actually found to be greater than for the case of pure Pt. A model is proposed which may reconcile the results of absorption edge measurements and rho/sub d/(E/sub f/) determinations.

55960 **(BNL—33605) EXAFS study of Metglas 2605 CO.** Hayes, G.H.; Budnick, J.I.; Choi, M.H.; Hines, W.A.; Pease, D.M.; Sayers, D.E.; Heald, S.M. (Connecticut Univ., Storrs (USA); North Carolina State Univ., Raleigh (USA). Dept. of Physics; Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 6p. (CONF-830888—10). NTIS, PC A02/MF A01. Order Number DE84001203.

From 5. international conference on liquid and amorphous metals; Los Angeles, CA, USA (15 Aug 1983).

The environment of the Fe and Co sites in Metglas 2605 CO ($Fe_{37}Co_{18}B_{14}Si_1$) has been investigated by the EXAFS technique. Studies were conducted on alloys subjected to a magnetic anneal, as well as alloys in the as fabricated condition. The EXAFS measurements were carried out with the x-ray polarization directions parallel and perpendicular to the ribbon direction. It is found the average distance from a Co site to the first transition metal coordination shell is always less than the corresponding distance for an Fe site. In addition, upon comparing data taken at room temperature with that collected at nitrogen temperature, an anisotropic behavior is detected in the fractional change in disorder.

55961 (BNL—51679, pp 76-82) **Extractive metallurgy: possible technology transfer for the processing of coal and coal wastes.** Miller, J.D. (Univ. of Utah, Salt Lake City). 1982. NTIS, PC A08/MF A01. (CONF-8206173—).

From DOE workshop on resources from coal, coal wastes, and ash; Reston, VA, USA (9 Jun 1982).

After reviewing the methods of ore processing and in the recovery of metals, the paper considers the possible application of such methods to the recovery of aluminium and silicon from coal ashes (mainly by the line soda sinter process and carbothermic reduction under nitrogen). The flotation recovery of coal fines is also considered. (LTN)

55962 **(CEA-CONF—6519) Disk pressure selection of materials and hydrogen environments.** Fidelle, J.P. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Nov 1982. 15p. (In French, English). (CONF-821127—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703429.

From ASM conference on current solutions to hydrogen problems in steels; Washington, DC, USA (1 Nov 1982).

This short note reminds the H-related phenomena for the study of which the Disk Pressure Technique can be used, as well as relevant literature. Next, acceptance criteria for materials and environmental conditions are discussed. Finally the case of blistering is discussed in relationship with hydrogen embrittlement, especially hydrogen gas embritlement.

55963 **(CEA-CONF—6592) Application of J integral concept for very small stainless austenitic steel samples. Experimental point of view.** Chavaillard, J.P.; Miannay, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1982. 15p. (In French). (CONF-821245—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703430.

From OCDE meeting on critical review of ductile fracture test methods; Paris, France (1 Dec 1982).

In some applications, small-sized structures with small notches are studied under tension. This study refers to such structures with a research of relevant parameters to describe ductible fractures. The J integral is in harmony with experiments for large cracks.

55964 (CONF-820258—, pp vp) **Long time effects in radiation enhanced permeation of H_2 through stainless steel tubes.** Schwarzinger, G.; Dobrozemsky, R. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Physik-Inst. 1982. Studentenfoerderungsgesellschaft m.b.H., Innsbruck, Austria N/P. (INIS-mf—7893).

From Symposium on atomic and surface physics; Maria Alm/Salzburg, Austria (7 Feb 1982).

The aim of this research is to give the particulars of influences of penetrating radiation on permeation and diffusion processes of hydrogen isotopes in stainless steel. Short time as well as long time effects have been investigated. Such processes are not only of interest for the fuel inventory of fusion reactors, but also for environmental aspects (tritium release).

55965 **(CONF-830942—7) Corrosion of ferrous alloys in eutectic lead-lithium environments.** Chopra, O.K.; Smith, D.L. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84000593.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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Corrosion data have been obtained on austenitic prime candidate alloy (PCA) and Type 316 stainless steel and ferritic HT-9 and Fe-9Cr-1Mo steels in a flowing Pb-17 at. % Li environment at 727 and 700 K (454 and 427°C). The results indicate that the dissolution rates for both austenitic and ferritic steels in Pb-17Li are an order of magnitude greater than in flowing lithium. The influence of time, temperature, and alloy composition on the corrosion behavior in Pb-17Li is similar to that in lithium. The weight losses for the austenitic steels are an order of magnitude greater than for the ferritic steels. The rate of weight loss for the ferritic steels is constant, whereas the dissolution rates for the austenitic steels decrease with time. After exposure to Pb-17Li, the austenitic steels develop a very weak and porous ferrite layer which easily spalls from the specimen surface.

55966 **(CONF-830942—8) Comparison of measured and calculated helium production in nickel using newly evaluated neutron cross sections for ^{59}Ni.** Greenwood, L.R.; Kneff, D.W.; Skowronski, R.P.; Mann, F.M. (Argonne National Lab., IL (USA); Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group; Hanford Engineering Development Lab., Richland, WA (USA)). 1983. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE84000565.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Fusion reactors will produce high levels of helium in surrounding materials with a helium (appm)-to-displacement ratio of about 10-to-1 in stainless steel. This high ratio can be obtained in mixed-spectrum reactors, which are used for fusion materials testing, due to unusually high thermal neutron cross sections for the sequential reactions ^{58}Ni(n,γ)^{59}Ni(n,α)^{56}Fe. The high-energy (~ 340 keV)^{56}Fe recoils also add significantly to the displacement damage at the rate of one DPA per 567 appm helium. Until now, the calculation of helium production in nickel has been done in a semi-empirical manner due to a lack of evaluated cross sections for ^{59}Ni. However, this approach cannot be readily transferred between different reactors since we do not know the contributions from epithermal neutrons in different neutron spectra. A new evaluation of the ^{59}Ni cross sections has recently been completed, permitting us to calculate all of the required reaction rates for any given neutron spectrum. Radiometric dosimetry and helium measurements have recently been completed for several different mixed-spectrum reactors. Precise comparisons of the helium production cross sections and measurements can thus be made in well-characterized neutron spectra. Data are presented for several recent fusion materials irradiations in the Oak Ridge Research Reactor and High Flux Isotopes Reactor at Oak Ridge National Laboratory and for the Experimental Breeder Reactor II at Argonne National Laboratory. Procedures are recommended for calculating helium production for nickel-bearing materials in any neutron spectrum.

55967 **(CONF-830942—9) Comparison of compression properties and swelling of beryllium irradiated at various temperatures.** Beeston, J.M.; Miller, L.G.; Wood, E.L. Jr.; Moir, R.W. (Argonne National Lab., Idaho Falls, ID (USA); EG and G Idaho, Inc., Idaho Falls (USA); Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01. Order Number DE84000597.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

A beryllium cylinder irradiated in Experimental Breeder Reactor (EBR-II) for four years at 700 to 760 K to a neutron fluence of 8.13 x 10^{25} n/cm^2 (total) or 1 x 10^{22} n/cm^2 (E > 1 MeV) was cut into samples and tested. Yield strength and plastic strain was determined in compression tests at 300, 723, 823 K and after annealing at 1173 K for one hour. The immersion density and helium content were measured on samples. An equation for swelling was derived from the data by regression analysis. The microstructure showed agglomeration of helium in voids or bubbles at the grain boundaries.

55968 **(CONF-830942—15) Influence of a flowing-lithium environment on the fatigue and tensile properties of Type 316 stainless steel.** Chopra, O.K.; Smith, D.L. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84000611.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Low-cycle fatigue and tensile data have been obtained on Type 316 stainless steel in a flowing lithium environment of controlled purity. The results show that the fatigue life of the steel in flowing lithium at 755 K is greater than in air. Preexposure of the material to lithium reduces fatigue life. The reduction in fatigue life may be attributed to the formation of a weak ferrite layer after lithium exposure. Tensile data for cold-worked Type 316 stainless steel indicate that at temperatures between 476 and 755 K, a flowing lithium environment has little or no effect on the tensile properties of the steel.

55969 **(CONF-830942—16) Diffusivities of hydrogen in yttrium and yttrium alloys.** Fisher, P.W.; Tanase, M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84000411.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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Diffusivities of hydrogen in yttrium, yttrium-niobium (Y-Nb) alloy (3:7), yttrium-niobium (Y-Nb) composite (3:7), and yttrium-thorium (Y-Th) alloy (4:1) in the Sieverts region were measured by gas absorption in the temperature range from 960 to 1160°K. The diffusivity of hydrogen in yttrium was found to be D = 300 exp(-160,000/RT), where R = 8.314 J.K^{-1}.mol^{-1}. Above 1000 K, diffusivities are in the following order: D(Y-Nb composite) > D(Y-Nb alloy) > D(Y-Th alloy) > D(Y), where D(Y-Nb composite) = 2.4 D(Y) and D(Y-Nb alloy) = 1.5 D(Y). Below 1000 K, effective diffusivities of the alloys become quite erratic and fall below those for yttrium.

55970 **(CONF-830942—22) Low-cycle fatigue behavior of oxygen-free high-conductivity copper at 300°C in high vacuum.** Liu, K.C.; Loring, C.M. Jr. (Oak Ridge National Lab., TN (USA); Oak Ridge Y-12 Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84000725.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

In-vacuum fatigue tests were performed on commercially-pure OFHC copper and 35% Au-65% Cu brazing filler metal at 300°C. Excessive recrystallization due to exposure in the 1025°C brazing temperature cycle was detrimental to the fatigue life of the base metal; cold work was beneficial to the fatigue resistance. Triple-point cracking and grain boundary sliding were the prevailing modes of fatigue failure observed in the full-size specimens. However, a mixed morphology of ductile and cleavage-like fracture was observed on the fracture surface of the subsize specimen in which the grain structure appeared to have undergone a change because of the presence of surface cold work. The braze has superior fatigue resistance, but to exploit the maximum strength, the brazed joint must be devoid of defects such as cavities and cracks.

55971 **(CONF-830942—26) Tensile properties of unirradiated PCA from room temperature to 700°C.** Braski, D.N.; Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84000330.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The tensile properties of Prime Candidate Alloy (PCA) austenitic stainless steel after three different thermomechanical treatments were determined from room temperature to 700°C. The solution-annealed PCA had the lowest strength and highest ductility, while the reverse was true for the 25%-cold-worked material. The PCA containing titanium-rich MC particles fell between the other two heats. The cold-worked PCA had nearly the same tensile properties as cold-worked type 316 stainless steel. Both alloys showed ductility minima at 300°C.

55972 **(CONF-830942—27) Fatigue performance of HFIR-irradiated Nimonic PE-16 at 430°C.** Grossbeck, M.L.; Liu, K.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84000341.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Nimonic PE-16 was irradiated in the HFIR to 6 to 9 dpa and 560 to 1000 at. ppM He at 430°C. Postirradiation fatigue tests revealed a reduction in fatigue life by about a factor of 10 at 430°C. In contrast to AISI type 316 stainless steel, no endurance limit was observed. All irradiated specimens exhibited some intergranular fracture with an increasing tendency toward cleavage-like intragranular fracture for low strain ranges.

55973 **(CONF-830942—28) Microstructure of 9 Cr-1 MoVNb steel irradiated to 40 dpa at elevated temperatures in HFIR.** Vitek, J.M.; Klueh, R.L. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84000339.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

As part of an effort by the Office of Fusion Energy to evaluate the irradiation behavior of ferritic steels, a 9 Cr-1 MoVNb alloy was irradiated in HFIR to a dose of ~ 36 dpa at temperatures of 300, 400, 500, and 600°C. In addition to the displacement damage produced during irradiation, a transmutation reaction of nickel during HFIR irradiation resulted in the simultaneous production of ~ 30 at. ppM He. Electron microscopy disks in the normalized and tempered condition were irradiated, and the microstructures were evaluated as a function of irradiation temperature. A few small cavities were observed after irradiation at 300, 500, and 600°C. However, a pronounced cavity microstructure was found after irradiation at 400°C. At this temperature, the cavities had a volume-averaged diameter of 15 nm and a concentration of 1.1 x 10^{21} m^{-3}, resulting in a void-swelling contribution of 0.19%. The cavities at 400°C were homogeneously distributed throughout the tempered martensite matrix, and showed no preference for lath boundaries or precipitate interfaces. The results are compared to those recently reported on a similarly irradiated 12 Cr-1 MoVW ferritic steel.

55974 **(CONF-830942—33) Comparison of the irradiated tensile properties of a high-manganese austenitic steel and type 16 stainless steel.** Klueh, R.L.; Grossbeck, M.L. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84000260.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The USSR steel EP-838 is a high-manganese (13.5%), low-nickel (4.2%) steel that also has lower chromium and molybdenum than type 316 stainless steel. Tensile specimens of 20%-cold-worked EP-838 and type 316 stainless steel were irradiated in the High Flux Isotope Reactor (HFIR) at the coolant temperature (~ 50°C). A displacement damage level of 5.2 dpa was reached for the EP-838 and up to 9.5 dpa for the type 316 stainless steel. Tensile tests at room temperature and 300°C on the two steels indicated that the irradiation led to increased strength and decreased ductility compared to the unirradiated steels. Although the 0.2% yield stress of the type 316 stainless steel in the unirradiated condition was greater than that for the EP-838, after irradiation there was essentially no difference between the strength or ductility of the two steels. The results indicate that the replacement of the majority of the nickel by manganese and a reduction of chromium and molybdenum in an austenitic stainless steel of composition near that for type 316 stainless steel has little effect on the irradiated and unirradiated tensile properties at low temperatures.

55975 **(CONF-831187—3) Magnetic properties of Mo/Ni superlattices.** Schuller, I.K.; Grimsditch, M. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84000568.

From MMM conference; Pittsburg, PA, USA (8 Nov 1983).

We have studied the magnetic properties of Mo/Ni non-lattice matched superlattices. The DC magnetization was measured in the temperature range 5 to 300°K and in magnetic fields up to 10 kG. The saturation magnetization and the Curie temperature behavior are consistent with expectations based on thin film effects. However, there are indications of ferromagnetic coupling across the non-magnetic metal. Light scattering measurements were performed for the first time to study the magnon spectrum in superlattices. The Brillouin magnon spectra obtained from Mo/Ni superlattices show characteristic features associated with the collective behavior of the superlattice and are in good agreement with earlier theoretical predictions.

55976 (INIS-mf—8476, pp vp) **Effect of repeated plastic deformations on residual strength of steels for nuclear programme.** Janda, R.; Mentl, V. (Skoda, Plzen (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.1).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

The trial bodies were made of CrMoV steel used for reactor pressure vessels. The bodies were loaded with cyclic repeated stress over a period corresponding to approximately 50, 75 and 98% of the total time to fracture at corresponding stress. Following cyclic stress a sharp surface crack was formed in the trial bodies by high-cycle bending stress. In order to induce artificial deformation aging, the trial bodies were exposed to a temperature of 350 degC for a period of three hours; cooling took place in the air. Values of residual strength are graphically represented for trial bodies affected in different ways by high-deformation strain. The significant effect of the previous high-deformation cyclic strain on the residual strength of bodies with surface cracks was not manifested. The experiments took place at a temperature of 293K. (J.P.).

55977 (INIS-mf—8476, pp vp) **Process of 15KH2MFA steel damage at low cycle fatigue.** Gregor, V. (Vyskumny Ustav Zvaracsky, Bratislava (Czechoslovakia)). [nd]. (In Slovak). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.1).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

Samples of 15Kh2MFA steel were used for the experiment, such as is developed for WWER pressure vessels. Monitored was the dependence of fatigue crack propagation on the number of loading cycles at levels of plastic deformation +-epsilonsub(P)=0.15, 0.20, 0.25, 0.30%. The experiment showed that there is a linear dependence of crack propagation on the number of cycles. The slope of the linear dependence with a value of 21 mm/c makes possible the determination of the residual lifetime of the initial materials. (J.P.).

55978 (INIS-mf—8476, pp vp) **Application of dynamic fracture mechanics in determining crack arrest temperature.** Bilek, Z.; Holzmann, M. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie:. [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.1).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

Crack arrest temperature and its dependence on external stress was determined in structural steel for pressure vessels. On laboratory samples the dependence was ascertained of the dynamic fracture toughness on the rate of the crack propagation and on temperature. The values obtained by numerical simulation of crack propagation using the finite element method were in good agreement with experimental results. (J.B.).

55979 (INIS-mf—8476, pp vp) **Identification of sites with reduced resistance to brittle fracture initiation.** Koula, V.; Turek, P. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)); Cermak, F. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.1).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

The ultrasonic method was used to determine the parameters of the statistical distribution of fracture toughness values. Prior to the cycling of fatigue cracks the attenuation of ultrasound was measured using 5, 10 and 15 MHz probes. The probes were applied to the sample at the head of the fatigue crack. The dependence was found of the fracture toughness on the parameter defined as the difference between the first and second echoes. A diagram is given of using nondestructive methods for the identification of the type of statistical distribution of values of fracture toughness. (J.P.).

55980 **(INIS-mf—8476) Structure damage processesand fault diagnostics. Vol. 1. National ICF conference.** (Ceskoslovenska Akademie Ved, Plzen. Ceskoslovenska Spolecnost Nauky o Kovech). [nd]. 34p. (In Czech). (CONF-8010336—Vol.1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780002.

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

Separate abstracts are presented for each of the papers included in the data base.

55981 **(LA-UR—83-2566) Radiation-damage calculations with NJOY.** MacFarlane, R.E.; Muir, D.W.; Mann, F.W. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 7p. (CONF-830942—35). NTIS, PC A02/MF A01. Order Number DE84001399.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Atomic displacement, gas production, transmutation, and nuclear heating can all be calculated with the NJOY nuclear data processing system using evaluated data in ENDF/B format. Using NJOY helps assure consistency between damage cross sections and those used for transport, and NJOY provides convenient interface formats for linking data to application codes. Unique features of the damage calculation include a simple momentum balance treatment for radiative capture and a new model for (n, particle) reactions based on statistical model calculations. Sample results for iron and nickel are given and compared with the results of other methods.

55982 **(LA-UR—83-2830) Interplay between superconductivity and itinerant ferromagnetism in Y_9Co_7 at high pressure.** Huang, C.Y.; Wolf, S.A.; Olsen, C.E.; Fuller, W.W.; Huang, J.H.; Ting, C.S. (Los Alamos National Lab., NM (USA); Naval Research Lab., Washington, DC (USA); Houston Univ., TX (USA). Dept. of Physics). 1983. Contract W-7405-ENG-36. 11p. (CONF-830763—16). NTIS, PC A02/MF A01. Order Number DE84001034.

From 9. AIRAPT conference; Albany, NY, USA (25 Jul 1983).

The theory of the interplay between superconductivity and itinerant ferromagnetism based on the single conduction band model in the mean field approximation is summarized. This theory predicts that superconductivity and itinerant ferromagnetism cannot co-exist, that the higher temperature magnetic phase can transform into the low temperature superconducting state, and that a superconducting state will not transform into a ferromagnetic state at a temperature below the superconducting transition. For the magnetic superconductor Y_9Co_7 we have reviewed the experimental results and in particular, we have shown that pressure suppresses magnetism resulting in a higher superconducting transition temperature and have concluded that Y_9Co_7 is an itinerant magnet. Pressure also sharpens the superconducting transition and increases the upper critical field, signifying that the ferromagnetic correlations and superconducting fluctuations co-exist but very spatially. For pressures greater than 6 kbar, the magnetoresistance is always positive, further indicating the suppression of magnetism by high pressure. Several microscopic experiments and some improvement in theory are suggested.

55983 **(LBL—15868) Vibrational spectroscopy of chemisorbed molecules by infrared emission.** Chiang, S.; Tobin, R.G.; Richards, P.L. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 25p. (CONF-831171—7). NTIS, PC A02/MF A01. Order Number DE84000956.

From American Vacuum Society meeting; Boston, MA, USA (1 Nov 1983).

The technique of infrared emission spectroscopy has been developed in order to observe vibrational modes of molecules adsorbed on clean, single crystal metal surfaces. A novel apparatus has been constructed which measures the emission from a single crystal sample in thermal equilibrium at room temperature. The apparatus consists of a liquid helium cooled infrared grating spectrometer coupled to an ultrahigh vacuum system equipped with surface preparation and characterization facilities. The system is capable of measuring over the frequency range from 330 to 3000 cm^{-1} with a resolution of 1 to 15 cm^{-1}. Using this technique, we have measured the linewidths of both the carbon-metal and carbon-oxygen stretching vibrations of monolayer coverage of CO on Ni(100).

55984 **(N—8323420) Influence of carburization on the room temperature tensile properties of high temperature alloys.** Ennis, P.J.; Lupton, D.F.; Nickel, H.; Schuster, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). May 1982. 65p. (JUEL—1786; ISSN—0366-0885). NTIS, PC A04/MF A01.

The influence of both thermal exposure and carburization at 800 deg C and above on the room temperature tensile properties of INCOLOY 800 H, INCONEL 617, HASTELLOY X and NIMONIC 86 was studied and the results were compared with literature data. The room temperature ductility of INCOLOY 800 H is much less sensitive to carburization than that of the nickel based alloys. This is attributed to the greater volume fraction of carbide formed in the nickel based alloys for a particular bulk carbon content. In the nickel based alloys carbide volume fractions are higher than in IRON based alloys due to the lower solubility of carbon and to the formation of M6C carbides. The ductility of reformer and intermediate heat exchanger (IHX) tubes after long service times in a process heat high temperature reactor was estimated using carburization rates found in corrosion experiments. The data indicate that a reformer tube of INCOLOY 800 H should retain a room temperature ductility equivalent to 5% tensile elongation over the anticipated service life of 140,000 h.

55985 **(N—8324638) The effects of Ni, Mo, Ti and Si on the mechanical properties of Cr free Mn steel (Fe-25Mn-5Al-2C).** Schuon, S.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1982. 18p. (NASA-TM—83355; E—1612). NTIS, PC A02/MF A01.

The FeMnAlC alloys may hold potential as Cr-free replacements for high strategic material iron base superalloys, but little is known about their intermediate temperature (650 C to 870 C) mechanical properties. The effects of alloying elements on the mechanical properties of model FeMnAlC alloys were studied. Results showed that modified FeMnAlC alloys had promising short term, intermediate temperature properties but had relatively poor stress rupture lives at 172 MPa and 788 C. Room temperature and 788 C tensile strength of FeMnAlC alloys were better than common cast stainless steels. Changes in room temperature tensile and 788 C tensile strength and ductility, and 788 C stress rupture life were correlated with changes in Ni, Mo, Ti, and Si levels due to alloying effects on interstitial carbon levels and carbide morphology. Fe-25Mn-5Al-2C had a very poor stress rupture life at 172 MPa and 788 C. Addition of carbide-forming elements improved the stress rupture life.

55986 **(N—8324640) Nitriding of titanium and titanium: 8 percent aluminum, 1 percent molybdenum, 1 percent vanadium alloy with an ion-beam source.** Gill, A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Apr 1983. 11p. (NASA-TP—2149; E—1227). NTIS, PC A02/MF A01.

Titanium and Ti-8Al-1Mo-1V alloy were nitrided with an ion-beam source of nitrogen or argon and nitrogen at a total pressure of 2 x 10 to the minus 4th power to 10 x 10 to the minus 4th power torr. The treated surface was characterized by surface profilometry, X-ray diffractometry, Auger electron spectroscopy and microhardness measurements. The tetragonal Ti_2N phase formed in pure titanium and Ti-8Al-1Mo-1V alloy with traces of AlN in the alloy. Two opposite processes competed during the ion-beam-nitriding process: (1) formation of nitrides in the surface layer and (2) sputtering of the nitrided layers by the ion beam. The highest surface hardnesses, about 500 kg/sq mm in titanium and 800 kg/sq mm in Ti-8Al-1Mo-1V, were obtained by ion nitriding with an ion beam of pure nitrogen at 4.2 x 10 to the minus 4th power torr at a beam voltage of 1000 V.

55987 **(ORNL/TM—8627) Metals and Ceramics Division Materials Science Program. Annual progress report for period ending December 31, 1982.** McHargue, C.J. (comp.). (Oak Ridge National Lab., TN (USA)). May 1983. Contract W-7405-ENG-26. 156p. NTIS, PC A08/MF A01. Order Number DE84000350.

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This report summarizes the activities of the Materials Sciences Program in the Metals and Ceramics Division. These activities constitute about one-fourth of the research and development conducted by the division. The major elements of the Materials Sciences Program can be grouped under the areas of (1) structural characterization, (2) high-temperature alloy studies, (3) structural ceramics, and (4) radiation effects.

55988 **(ORNL/TM—8830) Electrochemical etching of titanium-alloy castings.** Griess, J.C.; David, S.A.; Gray, R.J.; Houck, C.W. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 37p. NTIS, PC A03/MF A01. Order Number DE84000244.

This study was conducted to determine whether a potentiostatic electrochemical method could be used to etch selectively either the dendrites or the interdendritic material from Ti cast structures and thereby reveal their microstructures. Cast binary titanium alloys containing Mo, Ta, Nb, Al, and Cr and one multicomponent alloy containing Al, Ta, Nb, and Mo were polarized in sulfuric, oxalic, and fluosilicic acids and in a potassium hydroxide solution. Potentiostatic anodic polarization curves were obtained for each alloy. Results showed that the electrode potential for passivation was nearly the same for all alloys in a given acid, although the current density at the passivation potential varied from alloy to alloy. Generally for most alloying elements, the current density at the passivation potential decreased as the concentration of the alloying element increased, but not linearly. In the alkaline solution only the Ti-15% Cr alloy underwent significant dissolution, which occurred in the transpassive potential region. We were able to develop the dendritic structure with only the Ti-15% Mo, Ti-15% Ta, and Ti-15% Cr alloys. Possible reasons for our inability to delineate the dendritic structure in other alloys are discussed.

55989 **(PNL-SA—11320) Radiation hardening of oxygen-doped niobium by 14-MeV neutrons.** Bradley, E.R.; Jones, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 6p. (CONF-830942—13). NTIS, PC A02/MF A01. Order Number DE84000103.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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The flow properties of niobium containing 185 and 480 wt ppM oxygen have been studied following irradiation at 300K with T(d,n) neutrons to fluence levels ranging from 6×10^{20} to 2×10^{22} m^{-2}. Two hardening stages connected by a plateau region were observed in the niobium containing 185 wt ppM oxygen. Increasing the oxygen content by 300 wt ppM oxygen shifted the beginning of the high-fluence hardening stage from 6×10^{21} to 1×10^{21} m^{-2}, thereby eliminating the plateau region. This shift resulted in 1.5 times more hardening in the oxygen-doped niobium irradiated to fluence levels above 5×10^{21} m^{-2}.

55990 **(PNL-SA—11363) Theory of depleted-zone annealing during pulsed irradiation.** Simonen, E.P. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 6p. (CONF-830942—10). NTIS, PC A02/MF A01. Order Number DE84000120.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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Depleted zone annealing during pulsed irradiation at high damage rate, at low doses and over a narrow temperature range increased the predicted rate of microstructural development compared to steady irradiation predictions. The rates of defect annihilation at voids and dislocations were calculated for both pulsed and steady irradiation. Subsequently, the irradiation and material parameters that control the predicted pulsing influence were examined for pulsed ion and pulsed neutron irradiation of molybdenum. Pulsed ion effects, but not pulsed neutron effects were significant.

55991 **(PNL-SA—11425) Modeling crack-growth processes in fusion-reactor materials.** Jones, R.H.; Wolfer, W.G. (Pacific Northwest Lab., Richland, WA (USA); Wisconsin Univ., Madison (USA)). Sep 1983. Contract AC06-76RL01830. 14p. (CONF-830942—12). NTIS, PC A02/MF A01. Order Number DE84000477.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Models for the effect of the chemical environment on crack-growth processes in austenitic and ferritic stainless were evaluated. The effect of impurity segregation, yield strength, and hydrogen on crack growth of HT-9 and radiation-induced phosphorus segregation on the intergranular stress corrosion of 316SS have been evaluated. Moderate increases in impurity segregation and/or yield strength caused significant decreases in the K/sub IC/ and K/sub TH/ of HT-9, while less than a 10 fold increase in the intergranular stress-corrosion crack-growth rate of 316SS was predicted for a fluence of 100 dpa using the radiation-induced phosphorus segregation data of Brimhall et al. and the stress-corrosion model of Parkins. Therefore, while radiation-induced impurity segregation is greater in 316SS than HT-9, the effect of impurity segregation may be more pronounced in HT-9.

55992 **(SAND—82-2498) Fluidized-bed and salt-bath heat treating (AISI 4130 and 4340 alloy steels).** Cyrus, W.L. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1983. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01. Order Number DE84000979.

Using commercial alloy steels AISI 4130 and AISI 4340, a series of heat-treating, parametric studies were performed on specimens in both an electric fluidized-bed furnace and an electric neutral salt-bath furnace. An evaluation of heat-treating methods was performed by comparing tensile test data for the two alloy steels. Surface characterization of test specimens was performed using Auger analyses to discern effects, if any, caused by the heat-treatment method. This report presents certain test results for two significantly different heat-treating methods and places them side by side with published mechanical test data. Environmental and safety aspects of salt-bath and fluidized-bed heat treating are discussed.

55993 **(SAND—83-1028C) Trapping of sub-eV hydrogen and deuterium atoms in carbon.** Stangeby, P.C.; Auciello, O.; Haasz, A.A.; Doyle, B.L. (Toronto Univ., Ontario (Canada). Inst. for Aerospace Studies; Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830942—11). NTIS MF A01. Order Number DE84000051.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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Experimental results are presented on the trapping of sub-eV hydrogen and deuterium atoms in pyrolytic graphite (irradiated in the c direction) and papyex. Measurements were made by thermal desorption spectrometry, with the $D(^3He,p)^4He$ nuclear reaction analysis being used in some cases to check the validity of the thermal desorption results. Although some variation exists in the magnitude of trapped fluences for the different cases studied, the shapes of the trapped fluence vs. incident fluence curves are similar. The trapped fluences of sub eV D^0 are about an order of magnitude lower than those obtained for 50 eV D^+ ions, with a trend to saturation for fluences $> 2 \times 10^{19}/cm^2$.

55994 **(SAND—83-2134C) Measurement of thermal conductivity from high-temperature pulse diffusivity and calorimetry measurements.** Roth, E.P. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 22p. (CONF-8310163—1). NTIS, PC A02/MF A01. Order Number DE84000353.

From 18. international thermal conductivity conference; Rapid City, SD, USA (3 Oct 1983).

The measurement of the thermal conductivity of small samples over an extended temperature range is discussed. Experimental data on thermal diffusivity obtained by the laser pulse technique are combined with specific heat data, obtained either by differential scanning calorimetry or by vaporization calorimetry, to derive the thermal conductivity. As an example of the use of this technique, data are reported on the conductivity of an ASTM A517 steel over the temperature range 100 to 1200°C. The thermal diffusivity was derived from measured temperature vs time data obtained from a laser pulse diffusivity system designed and constructed at Sandia. A data reduction technique was used which simultaneously corrects

for finite pulse time effects and sample heat losses by radiation. The specific heat was measured directly at temperatures below 680°C using a commercial differential scanning calorimeter. For temperatures up to 1200°C, the specific heat was determined by differentiating a curve fit to the measured sample enthalpy. The enthalpy was measured using a liquid argon vaporization calorimeter developed at Sandia. The thermal conductivity of the A517 steel was then calculated over the entire temperature range. A classical Curie transition was observed during measurements of both the diffusivity and enthalpy. The effect of this transition on the measured thermal conductivity is discussed.

55995 **(UCRL—88974) Shock Hugoniot measurements on Ta to 0.78 TPa.** Froeschner, K.E.; Lee, R.S.; Chau, H.H.; Weingart, R.C. (Kansas State Univ., Manhattan (USA). Dept. of Physics; Lawrence Livermore National Lab., CA (USA)). 18 Aug 1983. Contract W-7405-ENG-48. 6p. (CONF-830719—53). NTIS, PC A02/MF A01. Order Number DE84000158.

From American Physical Society meeting on shock waves in condensed media; Santa Fe, NM, USA (18 Jul 1983).

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Symmetric impact shock Hugoniot measurements have been made on Ta with an electrically exploded foil gun system. The results obtained to date for the Hugoniot of Ta cover the range 0.19 to 0.78 TPa (impact velocities from 4.0 to 9.7 km/s) and agree with data obtained by other researchers to within 2.7% rms. Recent improvements in the system include electromagnetic shielding of impactor and target, continuous measurement of impactor velocity with a Fabry-Perot interferometer and computer-aided analysis of shot film. Conservative extrapolation from current operating conditions indicate that pressures of 1.1 to 1.5 TPa could be achieved with little difficulty.

55996 **(UCRL—89712) Aluminum as a global high-pressure equation-of-state standard.** Nellis, W.J.; Mitchell, A.C.; Holmes, N.C.; Trainor, R.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1983. Contract W-7405-ENG-48. 5p. (CONF-830768—2). NTIS, PC A02/MF A01. Order Number DE84000153.

From 9. International Association for the Advancement of High Pressure Science and Technology conference; Albany, NY, USA (25 Jul 1983).

Equation-of-state (EOS) standard materials are required for all static and dynamic high-pressure experiments. It is proposed that Al is an excellent candidate as an EOS standard, because of its simple s-p electronic structure. It can be both double-shocked and isentropically released to reach states off the Hugoniot. Its shock impedance is closely matched to that of LiF, a high-pressure window material. Double-shock experiments on Al gave agreement between effective Gruenеisen parameters and constant γ/V scaling at lower pressures. A shock impedance match was performed with Mo and Al in close proximity to an underground nuclear explosion. (DLC)

55997 **(UCRL—89741) Sign of the electric-field gradient at ^{111}Cd in Zr and Sb.** Kaufmann, E.N.; Krien, K.; Pielen, W.; Vianden, R. (Lawrence Livermore National Lab., CA (USA); Bonn Univ. (Germany, F.R.). Inst. fuer Strahlen- und Kernphysik). 1983. Contract W-7405-ENG-48. 6p. (CONF-830779—3). NTIS, PC A02/MF A01. Order Number DE84000070.

From 6. international conference on hyperfine interactions; Groningen, Netherlands (4 Jul 1983).

The β-γ TDPAC technique was applied to ^{111}Ag implanted in Zr and Sb metal single crystals in order to determine sign and magnitude of the quadrupole interaction at the site of ^{111}Cd in these metals. An analysis of the data taken at 293K yielded nu/sub Q/ = +15.4(6) MHz for ^{111}Cd in Zr and nu/sub Q/ = -107.5(20) MHz for ^{111}Cd in Sb. From these values electric field gradients of $+7.3(8)\times10^{16}$ V/cm^2 and $-5.56(62)\times10^{17}$ V/cm^2 for Cd in Zr and Sb are derived respectively.

55998 **Chemical compositions at and near the grain boundaries in bronze-processed superconducting Nb_3Sn.** Suenaga, M.; Jansen, W. (Division of Metallurgy and Materials Science, Brookhaven National Laboratory, Upton, New York 11973). *Applied Physics Letters;* **43**: No. 8, 791-793(15 Oct 1983). Contract AC02-76CH00016.

The chemical composition of bronze-processed Nb_3Sn at grain boundaries and its variation as a function of distance from the grain boundary were determined using Auger electron spectroscopy. The composition at the grain boundary was 44.1, 30.6, and 25.4 at. % for Nb, Sn, and Cu, respectively, and approached to the bulk value (~75 at. % Nb and ~25 at. % Sn) at ~20 A into the grain, as determined by a depth-profiling method.

55999 **Sensitivity analysis of surface structure determination by low energy electron diffraction.** Olszewski, G.B.; Bernasek, S.L. (Department of Chemistry, Princeton University, Princeton, New Jersey 08544). *Journal of Chemical Physics;* **79**: No. 7, 3581-3589(1 Oct 1983).

The determination of surface structures by low energy electron diffraction (LEED) has reached a stage of development where the assignment of atomic positions is no longer sufficient. An estimate of the accuracy of the derived structural information is necessary. A sensitivity analysis of the entire structural determination procedure provides this estimate. Several questions are addressed by this analysis. The effects of choices of the nongeometrical parameters on the geometrical results are studied. An estimate of the accuracy of structural assignments is inferred from the results. It appears that a simple least squares methodology (with an ultimate accuracy of +- 0.05 A) is the most logical choice for these problems.

56000 **Hydrogen diffusion in Nb-Ta alloys.** Matusiewicz, G.; Birnbaum, H.K. (University of Illinois at Urbana-Champaign, Urbana, IL 61801). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 1675-1678(Oct 1983). Contract AC02-76ER01198.

Gorsky effect measurements of the diffusivity of hydrogen were carried out in Nb-Ta alloys over th entire composition range and over the temperature range 165 K to 500 K. Measurements were made in the solid solution range of hydrogen solubilities and the diffusivities were corrected to zero hydrogen concentration using mean field interaction energies determined from the composition dependence of the diffusivities. Significant deviations from an Arrhenius temperature dependence were observed over the entire composition range. Over most of the temperature range the hydrogen diffusivity exhibite a monotonic decrease as the Ta concentration was increased. The mean field H-H interaction energie also varied with Ta concentration.

56001 **A study of the deformation and fracture of a dual-phase steel.** Szewczyk, A.F.; Gurland, J. (IBM East Fishkill Facility, Hopewell Junction, NY 12533). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 1821-1826(Oct 1983). Contract AC02-80ER10556.

A metallographic study of the tensile deformation and fracture of a commercial dual-phase steel shows that extensive plastic deformation of the martensite occurs mainly in the neck of the tensile specimen. The average load-transfer stress in martensite was roughly calculated from a shear-lag model, and it was found that it exceeds the estimated martensite yield stress value at strains corresponding to the ultimate uniform elongation, and beyond. Ductile fracture begins with void formation at martensite ferrite interfaces, most frequently at the poles of closely spaced martensite particles situated o ferrite grain boundaries. Large inclusions and martensite banding also affect the fracture process.

56002 **Mass transport of carbon in one and two phase iron-nickel alloys in a temperature gradient.** Okafor, I.C.I.; Carlson, O.N.; Martin, D.M. (Anambra State University of Technology, P.M.B. 1660, Enugu). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 1713-1870(Oct 1983). Contract W-7405-ENG-82.

The flux of carbon atoms induced by an applied temperature gradient on a specimen was investigated for an Fe-32.5 wt pct Ni alloy for six carbon concentrations. Carbon was found to migrate to the higher temperature region in the low carbon single phase alloys. However, in the higher carbon alloys an abrupt jump in carbon concentrations results when a portion of the specimen is in a two-phase region while the portion in the one-phase region exhibits the usual solute migration toward the higher temperature. A value of -12.2 + or - 0.4 kJ mol^{-1} was obtained for the heat of transport of carbon in the γ-phase Fe-Ni alloys for a wide range of carbon concentrations. A model for diffusion and thermotransport in multiphase systems is presented to explain the observed results.

56003 **Multilayer lattice relaxation at metal surfaces: A total-energy minimization.** Barnett, R.N.; Landman, U.; Cleveland, C.L. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). *Physical Review [Section] B: Condensed Matter;* **28**: No. 4, 1685-1695(15 Aug 1983). Contract AS05-77ER05489.

Relaxation at simple metal surfaces is studied via minimization of the total energy of a semi-infinite crystal. The expression for the total energy depends explicitly on the ionic positions, and is based on the use of pseudopotential theory and linear response. Electron screening is treated self-consistently including exchange and correlation effects. From a systematic investigation of the energetics underlying metal surface relaxation, for the low-index surfaces of bcc Na and fcc Al it is concluded that to achieve quantitative surface structural predictions requires the use of the full total-energy expression for the semi-infinite solid. Such an expression must maintain the three-dimensional nature of the system and account properly for the inhomogeneous surface electron density and the self-consistent response of the electron system to the ionic positions (screening). p Multilayer relaxation is shown to be essential for quantitative structural predictions and the origins of the phenomena are discussed in detail demonstrating the relative effects of electrostatic terms and band-structure contributions. The results exhibit damped oscillatory multilayer relaxations (the relaxation being particularly pronounced for the open faces) with a period equal to the bulk layer stacking period and agree well with available structural determinations obtained via the analysis of experimental data.

56004 **Photoacoustic study of plasmon resonance absorption in a diffraction grating.** Inagaki, T.; Motosuga, M.; Yamamori, K.; Arakawa, E.T. (Department of Physics, Osaka Kyoiku University, Tennoji, Osaka 543, Japan). *Physical Review [Section] B: Condensed Matter;* **28**: No. 4, 1740-1744(15 Aug 1983).

Plasmon resonance absorption in a 520-line/mm silver-coated diffraction grating was measured as a function of the angle of ruling orientation relative to the plane of photon incidence by a photoacoustic method. The experimental results of absorptance changes as a function of ruling orientation were found to be consistent with predictions from the first-order perturbation theory for roughness-induced photoabsorption. A discrepancy was found, however, between the absorptance values observed and the values calculated from the first-order theory.

56005 **Specific heat measurements of Pd in magnetic fields to 20 T.** Stewart, G.R.; Brandt, B.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **28**: No. 4, 2266-2267(15 Aug 1983).

We report accurate measurements of the specific heat of zone-refined, high-purity Pd between 6 and 17 K in fields of 10, 15, and 20 T. The change of the specific heat of this Pd in 20 T, averaged over the 14 different temperatures of measurement, compared with zero-field measurements at the same temperatures, is +1.0%. Within our limits of error (+- 2%), the results directly contradict previous specific heat results on Pd in fields to 11 T by Hsiang et al.

56006 **Dispersion of adsorbate vibrational modes: the c(2 x 2) oxygen overlayer on Ni(100).** Szeftel, J.M.; Lehwald, S.; Ibach, H.; Rahman, T.S.; Black, J.E.; Mills, D.L. (Institut fuer Grenzflachenforschung und Vakuumphysik, Kernforschungsanlage Juelich, D-5170 Juelich, West Germany). *Physical Review Letters;* **51**: No. 4, 268-271(25 Jul 1983).

The dispersion of surface vibrational modes associated with the c(2 x 2) adsorbate layer of oxygen on Ni(100) is measured throughout the two-dimensional Brillouin zone along the [110] direction. Two oxygen modes and two nickel surface phonons are observed. A lattice dynamical analysis gives good agreement with the data when the oxygen atom sits at ~0.9 A above the nickel surface at the fourfold hollow site.

56007 **Magnetic fluctuation scattering from metallic nickel above the Curie temperature.** Steinsvoll, O.; Majkrzak, C.F.; Shirane, G.; Wicksted, J. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **51**: No. 4, 300-303(25 Jul 1983). Contract AC02-76CH00016.

The spectral distribution of the magnetic fluctuation scattering from metallic nickel has been studied above the Curie temperature with unpolarized and polarized neutrons. The present measurements confirm previous results of a spin-wave-like mode above T/sub c/. It is shown, however, that the main part of the magnetic scattering above T/sub c/ does not come from the spin-wave ridge in (ω , q) space but from a spectral part centered at zero energy with a broad energy distribution.

56008 **Positron and electron channeling radiation from germanium.** Park, H.; Swent, R.L.; Kephart, J.O.; Pantell, R.H. (Stanford Univ., CA (USA). Dept. of Electrical Engineering); Berman, B.L. (Lawrence Livermore National Lab., CA (USA)); Datz, S.; Fearick, R.W. (Oak Ridge National Lab., TN (USA)). *Physics Letters [Section] A;* **96**: No. 1, 45-48(6 Jun 1983).

Channeling-radiation spectra have been obtained from a germanium crystal with approx.=54.3 MeV positrons and electrons and with 16.9 MeV electrons. Theoretical calculations were performed and are found to agree reasonably well with the experimental results. When the emission spectra for (110) planar channeling in diamond, silicon, and germanium are compared, the corresponding lines for both positrons and electrons are found to be lowest in energy for silicon.

56009 **A study of precipitation in interstitial alloys--IV; The precipitation sequence in Pt-C.** Westmacott, K.H.; Dahmen, U.; Witcomb, M.J. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *Acta Metallurgica;* **81**: No. 5, 755-762(May 1983). Contract AC03-76SF00098.

A systematic transmission electron microscopy study of the entire carbide precipitate nucleation and growth process in quenched, aged platinum has been made. Five distinct stages have been identified in the growth sequence, four coincide with changes in the Burgers and displacement vectors and the fifth in the configuration of the precipitates. Diffraction contrast analysis has shown that all the precipitate platelets lie in (001) matrix planes, are vacancy in character and are semi-coherent. Precipitates form initially by co-precipitation of vacancies and carbon atoms and the growth sequence follows a ripening type process. At intermediate aging temperatures voids become the preferred growth sites presumably acting as vacancy sources. Various aspects of the precipitation reaction have been explained from the standpoint of the role of vacancies (V), and the system can be treated either as a Pt-C binary or Pt-C-V ternary alloy.

56010 **A study of precipitation in interstitial alloys-III; Coherent and semicoherent growth mechanisms.** Dahmen, U.; Westmacott, K.H.; Witcomb, M.J. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *Acta Metallurgica;* **31**: No. 5, 749-754(May 1983). Contract AC03-76SF00098.

Frank and Shockley partial dislocations have been generalized using the coherency concept of Olson and Cohen to describe coherent and semi-coherent growth ledges on plate-shaped precipitates. Carbide platelet precipitate growth on (001) planes in platinum was quantified in these term using displacement fringe and strain contrast analysis of dislocations surrounding the precipitates. The first two stages in the growth sequence proceeded solely by semi-coherent ledges associated with a4 ⅀001⅁ (Frank-type) dislocations. These stages thus correspond to the co-precipitation of va-

cancies and carbon atoms. Coherent ledges were observed only occasionally during the third stage of growth, the ledge being bounded by /SUP a/ $_4$≦201≧ (Shockley-type) dislocations. The uniqueness of this result is interpreted in terms of the low solubility of carbon in platinum which results in similar concentrations of quenched-in vacancies and carbon atoms.

56011 **A study of precipitation in interstitial alloys-II; A new metastable carbide phase in platinum.** Witcomb, M.J.; Dahmen, U.; Westmacott, K.H. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *Acta Metallurgica;* **31**: No. 5, 743-748(May 1983). Contract AC03-76SF00098.

Contrast and convergent beam diffraction studies of precipitates in quenched, aged platinum containing about 800 atomic ppm carbon have identified a body-centered tetragonal structure with a = 0.39 nm, c = 0.59 nm, c/a = 1.5. An investigation of the microstructure of similarly treated platinum of various purities and of platinum doped with carbon indicates the precipitates to be a metastable carbide of composition at or close to Pt C.

56012 **The projected atomic structure of a large angle (001) Σ = 5 (0 = 36.9) twist boundary in gold: Diffraction analysis and theoretical predictions.** Budai, J.; Bristowe, P.D.; Sass, S.L. (Department of Materials Science and Engineering, Cornell University, Ithaca, NY 14853). *Acta Metallurgica;* **31**: No. 5, 699-712(May 1983). Contract AC02-78ER05002.

The projected atomic structure of a large angle (001) Σ = 5 (0 = 36.9) twist boundary in Au was determined using X-ray diffraction techniques. The extra reflections resulting from the periodic structure of the boundary were studied using synchrotron radiation. The observed structure factor rules are consistent with the boundary existing in the exact (no translation away from) coincidence configuration. The projected structure was determined using a variable coordinate and reliability factor analysis which was simplified by the low value of Σ, the boundary symmetry and the assumption o a thin boundary region. The structure thus determined consists of groups of atoms which have undergone large rotations about "0" elements in the planes immediately adjacent to the boundary. The structure is made up of separate patches of median f.c.c. structure in analogy with small angle boundaries. Various structures calculated by computer relaxation techniques using interatomic potentials are also presented and compared with the diffraction results. These structures also show rotational relaxations about "0" -elements but the degree of the rotation is much smaller than was determined by diffraction leading to a distortion of the median f.c.c. structure. Consequently, there is only limited correspondence between the computer results and experimental observations.

56013 **Irradiation effects on thermal conductivity of a light-water reactor pressure vessel steel.** Williams, R.K.; Nanstad, R.K.; Graves, R.S.; Berggren, R.G. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.). *Journal of Nuclear Materials;* **115**: No. 2/3, 211-215(Apr 1983).

A Mn-1/2Mo-1/2Ni steel (ASTM A533 grade B class 1) similar to the material used for construction of early pressurized water reactors was examined for irradiation-induced changes in thermal conductivity. The mechanical properties of this steel have been shown to be sensitive to irradiation. Testing of a standard sample in the range 30 to 90°C showed that the thermal conductivity measurements had an absolute uncertainty of about +-3%. Results on the control and irradiated samples showed a small (1.7%) increase in thermal conductivity after irradiation at about 290°C to fluences up to 2.4×10^{23} n/m² (E > 1 MeV). Thus, for the neutron irradiation conditions investigated, the thermal conductivity of this pressure vessel steel is not degraded.

56014 **Effects of sodium and lithium environments on mechanical properties of ferrous alloys.** Chopra, O.K. (Argonne National Lab., IL (USA). Materials Science and Technology Div.). *Journal of Nuclear Materials;* **115**: No. 2/3, 223-238(Apr 1983).

With 44 refs.

A review of the current status of work on the mechanical properties of structural materials in liquid sodium and lithium environments is presented. The influence of the environment as well as the effects of the microstructural and compositional changes that occur in austenitic and ferritic steels during long-term exposure are discussed. Requirements for additional data on mechanical properties are identified.

56015 **Effect of implanted helium on the high temperature mechanical properties of a model austenitic Fe-17%Cr-17%Ni alloy.** Schroeder, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung); Braski, D.N. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.). *Journal of Nuclear Materials;* **115**: No. 2/3, 297-306(Apr 1983).

Foils of the ternary alloy Fe-17 wt% Cr-17 wt% Ni were cyclotron-implanted with 160 appm helium and then creep rupture tested at 1023 K together with unimplanted controls. The range of the applied stress was 9.8 MPa till 39.2 MPa. In addition, a few tensile tests (epsilon = 1.5×10^{-3}/s) were performed with implanted and unimplanted specimens at the same temperature. The mechanical properties of the material are changed by the presence of helium - characteristically for high temperature helium embrittlement: reduced ductility, reduced creep rupture time, increased yield stress (matrix hardening) and intergranular fracture. The changes in the mechanical properties are accompanied by a change in the deformation mode from "climb and glide" (mixed with some grain boundary sliding) in the unimplanted samples to predominantly grain boundary sliding in the helium implanted ones. This can be correlated with high densities of helium bubbles in grain boundaries. Initiation of grain boundary cracks seems to be strongly inflaenced by very large helium bubbles at grain boundary triple point junctions.

56016 **New calculation of thermal neutron damage and helium production in nickel.** Greenwood, L.R. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials;* **115**: No. 2/3, 137-142(Apr 1983).

It has long been recognized that thermal neutron irradiations of nickel-bearing materials generate high levels of helium from the sequential $^{58}Ni(n,\gamma)^{59}Ni(n,\alpha)^{56}Fe$ nuclear reactions. This process is used to simulate fusion reactor helium-to-displacement damage rates in stainless steel during fission reactor irradiations. However, it has not previously been recognized that the ^{56}Fe recoils will also cause significant displacement damage. At thermal neutron energies the 340 keV ^{56}Fe recoil event will displace 1762 atoms in nickel. The helium (appm)-to-displacement ratio from this process will be 567, a value that can be used to correct previous displacement calculations in nickel-bearing materials. This effect can nearly double the displacement damage in nickel in HFIR at high neutron fluences.

56017 **X-ray diffraction study of the delta->α′ transformation in a Pu-2 at% Al alloy.** Zukas, E.G.; Hecker, S.S.; Pereyra, R.A. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials;* **115**: No. 1, 63-68(Mar 1983).

The face-centered cubic (fcc) delta phase of plutonium is stable from 310° to 458°C. An addition of 2.0 at% aluminum retains the delta phase metastably to room temperature. This delta phase transforms to α′ during subzero thermal treatments. Under hydrostatic compression at room temperature, the delta transforms initially to β′, and this then transforms to α′ at the higher pressures. During mechanical polishing, the delta phase transforms to α′. An X-ray diffraction study of this transformed zone by sequential removal of thin surface layers by electropolishing shows that this transformation is not directly from delta to α′, but from delta to γ with the γ phase then transforming to α′. There is no evidence for the presence of either the β or β′ phases when the delta phase is transformed by mechanical polishing.

56018 **Tritium permeability of nickel plated stainless steel 21-6-9 and of gold plated aluminum.** Bell, J.T.; Redman, J.D. *Journal of Materials for Energy Systems;* **4**: No. 4, 217-221(Mar 1983). Contract W-7405-ENG-26.

Tritium permeabilities of alloy 21-6-9 and of aluminum have been determined over the 200 to 750 °C and 300 to 460 °C ranges, respectively. Permeation behavior through cold worked alloy 21-6-9 was similar to that for other austenitic alloys, but behavior of an-

nealed alloy 21-6-9 was markedly different and suggested a structural transition near 560 °C. Permeabilities determined for nonoxidized aluminum were different from those given in earlier publications, but are believed to represent better hydrogen permeation through aluminum.

56019 The effects of liquid metal embrittlement on high temperature fatigue of 2.25 Cr-1 Mo steel in liquid lithium. Spencer, R.E.; Matlock, D.K.; Olson, D.L. (Owens Corning Fiberglas, Granville, OH). *Journal of Materials for Energy Systems;* **4**: No. 4, 187-194(Mar 1983).

The fatigue crack propagation characteristics of a 2.25 Cr-1 Mo steel were investigated in argon and lithium with either <100 ppm or approximately 2000 ppm dissolved nitrogen. Data, which extend those presented previously, were obtained for temperatures of 673 to 873 K and loading frequencies of 0.05 to 20 Hz. At a constant imposed stress intensity factor, the growth rate in argon decreased with an increase in frequency for all test temperatures. In contrast, the growth rate was enhanced by the presence of lithium and shown to increase significantly with an increase in frequency at the lower test temperatures. The lithium enhanced growth rates resulted from strain rate induced liquid metal embrittlement (LME). The loading frequency-temperature conditions necessary for LME were predicted from a model based on the achievement of a critical strain rate dependent flow stress at the tip of a propagating fatigue crack. The results correlated with fractographic observations which showed a transition from deformation controlled fatigue crack growth at low frequencies to LME controlled cleavage formation at high frequencies.

56020 Microstructural development and cracking behavior of AISI 304 stainless steel tested in time dependent fatigue modes. Ermi, A.M.; Moteff, J. (Hanford Engineering Development Laboratory, Richland, WA 99352). *Journal of Engineering Materials and Technology;* **105**: No. 1, 21-35(Jan 1983).

Transmission and scanning electron microscopy were used to study the substructural development, crack initiation and crack propagation of AISI 304 stainless steel tested in low-cycle fatigue with various hold times. Tests at 593°C, a strain rate of 4 E-03 s^{-1} and strain ranges of 0.5, 1.0 and 2.0 percent were interrupted at various fractions of the fatigue life, both during rapid hardening and during saturation. Cells developed during the first few percent of the fatigue life, depending on a threshold stress value, below which cells were not observed. The cell size had a different dependence on the relaxed tensile stress during rapid hardening than during saturation. A work-hardening model relating the peak saturation stress to strain and cell size also applied during the late stages of rapid hardening. The number of cycles to initiate a crack of one grain diameter and to propagate the crack to failure were proportionally reduced for one minute tension holds. For a 60 minute tension hold, crack propagation occupied a much smaller fraction of the fatigue life.

56021 Why ductile fracture mechanics. Ritchie, R.O. (Department of Materials Science and Mineral Engineering and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *Journal of Engineering Materials and Technology;* **105**: No. 1, 1-7(Jan 1983). Contract W-7405-ENG-48.

Until recently, the engineering application of fracture mechanics has been specific to a description of macroscopic fracture behavior in components and structural parts which remain nominally elastic under loading. While this approach, termed linear elastic fracture mechanics, has been found to be invaluable for the continuum analysis of crack growth in brittle and high strength materials, it is clearly inappropriate for characterizing failure in lower strength ductile alloys where extensive inelastic deformation precedes and accompanies crack initiation and subsequent propagation. Accordingly, much effort has been devoted in recent years toward the development of nonlinear or ductile fracture mechanics methodology to characterize fracture behavior under elastic/plastic conditions; an effort which has been principally motivated by problems in nuclear industry. In this paper, the concepts of ductile (elastic/plastic) fracture mechanics are introduced and applied to the problem of both stationary and nonstationary cracks. Specifically, the limitations inherent in this approach are defined, together with a description of the microstructural considerations and applications relevant to the failure of ductile materials by fracture, fatigue, and creep.

56022 Influence of environment on the load ratio dependence of fatigue thresholds in the pressure vessel steel. Suresh, S.; Ritchie, R.O. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). *Engineering Fracture Mechanics;* **18**: No. 4, 785-800(1983).

A study has been made of the influence of load ratio R on fatigue crack propagation behavior and specifically on the value of the fatigue crack growth threshold, ΔK_0, in a bainitic 2.25 Cr-1Mo pressure vessel steel tested at 50 Hz in aqueous, and moist and dry gaseous environments. Data are obtained for crack growth in a distilled water environment and are compared to previously published results in air and hydrogen. It is found that in distilled water the dependence of thresholds ΔK_0 values on R is far less marked than in moist air and dry hydrogen atmospheres where ΔK_0 values decrease sharply with increasing R. Furthermore, whereas in air and hydrogen, the threshold condition is characterized by a constant maximum stress intensity at low load ratios, and a constant alternating stress intensity at high load ratios, no such behavior is observed in water. Based on extensive measurements of crack face oxidation products using scanning Auger spectroscopy and on previous crack closure measurements using ultrasonics techniques, the role of load ratio in influencing near-threshold fatigue behavior is ascribed to mechanisms of crack closure specifically plasticity-induced closure and closure arising from crack face oxide debris. The implications are discussed in detail.

56023 Optimization of Fe/Cr/C base structural steels for improved strength and toughness. Sarikaya, M.; Steinberg, B.G.; Thomas, G. (Molecular Research Division, Lawrence Berkeley Laboratory and Department of Materials Science and Mineral Engineering, University of California, Berkeley, CA 94720). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 2227-2238(Dec 1982). Contract AC03-76SF00098.

Optimization of the composition and the heat treatments to provide a microduplex structure of dislocated-autotempered lath martensite and thin film retained austenite for good combinations of mechanical properties has been attained for Fe/Cr/C base steels. Substituting 0.5 wt pct Mo to reduce Cr from 4 pct to 3 pct did not affect the microstructures nor the properties. It was found that ai melting as compared to vacuum melting does not cause deterioration of toughness in Mn containing alloys but does so in Ni containing alloys. Tempered martensite embrittlement was confirmed as being due to the decomposition of retained austenite. Further improvements in the fracture toughness are achieved b double heat treatments which provide grain refinement. These alloys are considered to be very promising for structural applications.

56024 Effects of friction and high torque on fatigue crack propagation in mode III. Nayeb-Hashemi, H.; McClintock, F.A.; Ritchie, R.O. (Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 2197-2204(Dec 1982). Contract W-7405-ENG-26.

Turbo-generator and automotive shafts are often subjected to complex histories of high torques. To provide a basis for fatigue life estimation in such components, a study of fatigue crack propagation in Mode III (anti-plane shear) for a mill-annealed AISI 4140 steel (R /SUB B/ 88, 590 MN/m^2 tensile strength) has been undertaken, using torsionally-loaded, circumferentially-notched cylindrical specimens. As demonstrated previously for higher strength AISI 4340 steel, Mode III cyclic crack growth rates (dc/dN) /SUB III/ can be related to the alternating stress intensity factor ΔK /SUB III/ for conditions of small-scale yielding. However, to describe crack propagation behavior over an extended range of crack growth rates (about 10^{-6} to 10^{-2} mm per cycle), where crack growth proceeds under elastic-plastic and full plastic conditions, no correlation between (dc/dN) /SUB III/ and ΔK /SUB III/ is pos-

sible. Accordingly, a new parameter for torsional crack growth, termed the plastic strain intensity Γ /SUB III/, is introduced and is shown to provide a unique description of Mode III crack growth behavior for a wide range of testing conditions, provided a mean load reduces friction, abrasion, and interlocking between mating fracture surfaces A micro-mechanical model for the main radial Mode III growth is extended to high nominal stress levels, and predicts that Mode III fatigue crack propagation rates should be proportional to the range of plastic strain intensity (ΔΓ /SUB III/) if local Mode II growth rates are proportional to the displacements. Such predictions are shown to be in agreement with measured growth rates in AISI 4140 steel from 10^{-6} to 10^{-3} mm per cycle.

56025 **Grain boundary diffusion mechanisms in metals.** Balluffi, R.W. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 2069-2098(Dec 1982). Contract AC02-78ER05002.

In recent years it has become well established that fast diffusion along grain boundaries plays a key role in many important metallurgical processes including cases where net mass is transported along boundaries which act as sources and/or sinks for the fluxes of atoms. In addition, considerable advances have been made in understanding grain boundary structure, and new techniques have become available for studying kinetic phenomena in grain boundaries. This lecture attempts to review current knowledge of the atomistic mechanisms responsible for these grain boundary diffusion phenomena. Relevant aspects of the structure of grain boundaries and the point and line defects which may exist in grain boundaries are described first. The important experimental observations are then discussed. Diffusion models are then taken up, and it is concluded that the atomic migration occurs b a point defect exchange mechanism which, in at least the vast majority of boundaries in simple metals, most likely involves grain boundary vacancies. The grain boundary sources and/or sinks required to support divergences in the atomic (vacancy) fluxes are grain boundary dislocations. Phenomena therefore occur which resemble the Kirkendall Effect in the bulk lattice in certain respects. Additional topics are discussed which include effects of boundary structure on boundary diffusion and the question of whether or not boundary diffusion is faster along migrating than stationary boundaries.

56026 **Tensile and fracture properties of type 316 stainless steel after creep.** Gan, D. (Department of Materials Science, National Sun Yat-Sen University, Kaohsiung, Taiwan). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 2155-2164(Dec 1982). Contract AC02-76CH00016.

The effects of creep on the mechanical properties of type 316 stainless steel were studied. Tensile and Charpy specimens were machined from the oversize specimens crept at 750°C and 103 MPa. The ambient fracture energy was found to deteriorate rapidly after creep. The ambient yield stress was increased moderately, but the tensile ductility was severely reduced. The effects of intergranular carbides alone on mechanical properties were studied with specimens thermal aged without load. These carbides were shown to cause a moderate reduction in fracture energy and tensile ductility but had little effect on yield stress. Extensive grain boundary separations were observed on the fracture surfaces. SEM studies showed that these grain boundaries were covered with microvoids initiated by the dense intergranular carbides. Frequently, large dimples on grain boundary joined up and initiated shear fracture into the grain. In the crept specimens additional microstructural changes in the form of intragranular carbides and subgrain boundaries were observed. Both are responsible for the increas in yield stress and the further reduction in tensile ductility and fracture energy. The intragranular carbides also modified the size and density of the dimples on the fracture surfaces.

56027 **Observations of fracture surface chemistry on Cu-0.5 At. % Sb bicrystals.** Chuang, T.H.; Gust, W.; Heldt, L.A.; Hintz, M.B.; Hofmann, S.; Lutic, R.; Predel, B. (Max-Planck-Institut fur Metallforschung and Institut fur Metallkunde, Seestr. 75, D-7000 Stuttgart 1). *Scripta Metallurgica;* **16**: No. 12, 1437-1441(Dec 1982). Contract AC02-81ER10941.

For a given segregation heat treatment, the fracture mode is dependent upon intercrystalline misorientation. From the present data it cannot be determined if this behavior is a result of differences in segregant level alone or if other misorientation dependent interfacial properties are significant as well. Specimens having the same misorientations and thermal histories have relatively constant fracture surface chemistries. This implies that the fracture path through an interface of a particular type is well defined in the Cu-Sb system.

56028 **Tensile and fracture properties of type 316 stainless steel after creep.** Gan, D. (Brookhaven National Lab., Upton, NY). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13**: 2155-2163(Dec 1982). Contract AC02-76CH00016.

The effects of creep on the mechanical properties of type 316 stainless steel were studied. Tensile and Charpy specimens were machined from the oversize specimens crept at 750°C and 103 MPa. The ambient fracture energy was found to deteriorate rapidly after creep. The ambient yield stress was increased moderately, but the tensile ductility was severely reduced. The effects of intergranular carbides alone on mechanical properties were studied with specimens thermal aged without load. These carbides were shown to cause a moderate reduction in fracture energy and tensile ductility but had little effect on yield stress. Extensive grain boundary separations were observed on the fracture surfaces. SEM studies showed that these grain boundaries were covered with microvoids initiated by the dense intergranular carbides. Frequently, large dimples on grain boundary joined up and initiated shear fracture into the grain. In the crept specimens additional microstructural changes in the form of intragranular carbides and subgrain boundaries were observed. Both are responsible for the increase in yield stress and the further reduction in tensile ductility and fracture energy. The intragranular carbides also modified the size and density of the dimples on the fracture surfaces. 15 figures.

56029 **Hydrogen effects on the tensile properties of 21-6-9 stainless steel.** West, A.J. Jr.; Louthan, M.R. Jr. (Sandia National Laboratory, Livermore, CA 94550). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 2049-2053(Nov 1982).

The effect of hydrogen on the mechanical properties of a series of nineteen experimental heats of 21-6-9 stainless steel was investigated. The nineteen material groups covered a variety of forging processes, strength levels, grain sizes, and microstructures. The data show that absorbed hydrogen acts as an interstitial strengthener which increases the flow stress of 21-6-9 similar to the effects o carbon, nitrogen, and other interstitial atoms. The true stress for tensile instability was observed to be about1130 MPa for both uncharged and hydrogen charged specimens and appeared to be independent of process variables. Thermal charging and/or tensile in high pressure hydrogen indicates this austenitic stainless steel is susceptible to hydrogen-induced cracking at grain boundaries, slip bands, and other interfaces. A lack of hydrogen-induced effects at true stresses below 1100 MPa indicates a lower limit for the hydrogen-induced reduction in interfacial strength. Above a true stress of 110 MPa the extent of hydrogen induced reductions in interfacial strength is dependent on hydrogen concentration and increases as the hydrogen concentration increases. These observations are discussed in terms of several proposed hydrogen embrittlement theories.

56030 **Stress-corrosion cracking of sensitized type 304 stainless steel in thiosulfate solutions.** Newman, R.C.; Isaacs, H.S.; Sieradzki, K. (Metallurgists, Corrosion Science Group, Brookhaven National Laboratory, Upton, NY 11973). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 2015-2026(Nov 1982). Contract AC02-76CH00016.

The stress corrosion cracking of a sensitized Type 304 stainless steel has been studied at room temperature using controlled potentials and two concentrations of sodium thiosulfate. In both constant extension rate and constant load tests, the crack velocities attain extremely high values, up to 8 $\mu m\ s^{-1}$. Scratching electrode experiments conducted at various pH values on simulated grain

boundary materials show that both the crack initiation frequency and crack velocity are closely related to the repassivation rate of the grain boundary material as expected on a dissolution-controlled mechanism; however, th maximum crack velocity at any potential is consistently about two orders of magnitude higher than that predicted from the electrochemical data. Frequent grain boundary separation ahead of the crack tip is thought to occur, but retarded repassivation of the grain boundary material is a necessary feature of the cracking. Effects of strain-generated martensite are discussed.

56031 **The separate roles of subgrains and forest dislocations in the isotropic hardening of type 304 stainless steel.** Kassner, M.E.; Miller, A.K.; Sherby, O.D. (Materials Science Division, Lawrence Livermore National Laboratory, Livermore, CA 94550). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **13A**: 1977-1986(Nov 1982). Contract AM03-76SF00326.

Tests on 304 stainless steel were conducted involving first warm working in torsion, then cold working in torsion, and finally measurement of the elevated-temperature yield strength in compression. These tests permitted separation of the effects of subgrain size and forest dislocation density on the isotropic part of the flow stress. Forest dislocation strengthening appears to dominate in this material. Th results are best fitted by a root-mean-square summation of strength terms representing the contributions of solutes, forest dislocations, and subgrain boundaries. The same equation successfully predicts the flow stress during elevated-temperature transient deformation (under both constant strain rate and variable strain rate) from the transient dislocation substructure.

56032 **Stress-corrosion cracking of sensitized type 304 stainless steel in thiosulfate solutions.** Newman, R.C.; Sieradzki, K.; Isaacs, H.S. (Brookhaven National Lab., Upton, NY). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **13**: 2015-2026(Nov 1982). Contract AC02-76CH00016.

The stress corrosion cracking of a sensitized Type 304 stainless steel has been studied at room temperature using controlled potentials and two concentrations of sodium thiosulfate. In both constant extension rate and constant load tests, the crack velocities attain extremely high values, up to 8 $\mu m\ s^{-1}$. Scratching electrode experiments conducted at various pH values on simulated grain boundary material show that both the crack initiation frequency and crack velocity are closely related to the repassivation rate of the grain boundary material as expected on a dissolution-controlled mechanism; however, the maximum crack velocity at any potential is consistently about two orders of magnitude higher than that predicted from the electrochemical data. Frequent grain boundary separation ahead of the crack tip is thought to occur, but retarded repassivation of the grain boundary material is a necessary feature of the cracking. Effects of strain-generated martensite are discussed.

56033 **A geometric model for fatigue crack closure induced by fracture surface roughness.** Suresh, S.; Ritchie, R.O. (Department of Materials Science and Mineral Engineering, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* 1627-1632(Sep 1982). Contract W-7405-ENG-48.

Mechanisms for fatigue crack closure under plane strain conditions have recently been identified a very low (near-threshold) stress intensities in terms of effects of excess corrosion deposits or fracture surface roughness in promoting premature closure of the crack. In the present paper, a geometric model is presented for crack closure induced by fracture surface roughness. This model specifically addresses the contribution from both Mode I and Mode II crack tip displacements in addition to considering the nature of the fracture surface morphology. The implications of this model are briefly discussed in light of the roles of grain size, yield strength, microstructure, and crack size in influencing near-threshold fatigue behavior in engineering alloys.

56034 **Correlation of substructure with time-dependent fatigue properties of AISI 304 stainless steel.** Ermi, A.M.; Moteff, J. (Materials Science and Metallurgical Engineering Department, University of Cincinnati, Cincinnati, OH 45221). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **13A**: 1577-1586(Sep 1982).

Transmission electron microscopy was employed to study the substructure of AISI 304 stainless stee tested at 482, 593, and 650 °C in low-cycle fatigue with various hold times. Total strains investigated ranged from 0.5 to 2.0 pct, strain rates of 4 E-03 and 4 E-05 s^{-1}. The cell size was found to b inversely related to the relaxed tensile saturation stress, but with different constants of proportionality for the two strain rates. At the lower strain rate, substructures tended to resemble those produce by pure creep. A modified work-hardening theory was used to relate the peak saturation stress to both plastic strain and cell size.

56035 **Characterization of a rapidly solidified iron-based superalloy.** Smugeresky, J.E. (Sandia National Laboratories, Livermore, CA 94550). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **13A**: 1535-1546(Sep 1982). Contract AC04-76DP00789.

Rapidly-solidified powders of an iron-based superalloy were characterized before and after consolidation by hot isostatic pressing. Powders made by inert gas atomization were compared to powders made by centrifugal atomization. Although many of the powder characteristics were similar, the microstructures were not. The inert gas atomized powder structure is cellular while the centrifugally atomized powder structure is dendritic. In general the finer powder particles have the finer micro structure with the effect more noticeable in centrifugally atomized powders. After consolidation, the differences in microstructure are more dependent on the consolidation temperature and postconsolidation heat treatment than in the powder type or size. Higher consolidation temperatures and/or post-consolidation heat treatment will result in transformation of the as-solidified microstructures. The transformed microstructure and the mechanical properties can in some cases be related to the assolidified structure. Heat treatment is needed to obtain mechanical properties equivalent to those of ingot metallurgy processed material.

56036 **Geometric model for fatigue crack closure induced by fracture surface roughness.** Suresh, S.; Ritchie, R.O. (Lawrence Berkeley Lab., CA). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **13**: 1627-1631(Sep 1982). Contract W-7405-ENG-48.

Mechanisms for fatigue crack closure under plane strain conditions have recently been identified at very low (near-threshold) stress intensities in terms of effects of excess corrosion deposits or fracture surface roughness in promoting premature closure of the crack. In the present paper, a geometric model is presented for crack closure induced by fracture surface roughness. This model specifically addresses the contribution from both Mode I and Mode II crack tip displacements in addition to considering the nature of the fracture surface morphology. The implications of this model are briefly discussed in light of the roles of grain size, yield strength, microstructure, and crack size in influencing near-threshold fatigue behavior in engineering alloys.

56037 **Crack growth retardation due to micro-roughness: a mechanism for overload effects in fatigue.** Suresh, S. (Department of Materials Science and Mineral Engineering and Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *Scripta Metallurgica;* **16**: No. 8, 995-998(Aug 1982). Contract AC03-76SF00098.

A new mechanism for fatigue crack growth retardation following an overload is presented in this paper, based on a micro-roughness model. It is reasoned, with the aid of extensive experimental evidence available in the literature, that retardation following an overload is governed by the micromechanisms of near-threshold crack growth. This model is found to rationalize a number of hitherto unexplained experimental observations. Moreover, the present arguments, which suggest that plasticity-induced crack closure is not likely to be the primary mechanism for retardation following single overloads, do not exclude the role of residual

stresses or blunting, but provide further mechanistic basis to account for the inconsistencies in the previous models. Additional sources of prolonged retardation, in terms of crack closure due to corrosion debris formed in moist environments, are suggested. It is pointed out that such environmental effects could play an important role in post-overload crack growth in certain alloy systems.

56038 STEM observation of crystallization in thin films of amorphous $Fe_{40}Ni_{40}P_{14}B_6$. Hall, I.W.; Kramer, J.J. (Materials and Metallurgy Faculty, College of Engineering, University of Delaware, Newark, Delaware 19711). *Scripta Metallurgica;* **16**: No. 8, 917-920(Aug 1982). Contract AC02-80ER10571.

The results reported show that crystallization in thin films of Metglas 2826 can occur even at room temperature. Microanalysis and microdiffraction data have established the structure and composition of the phases.

56039 Flow localization and shear band formation in a precipitation strengthened austenitic stainless steel. Mataya, M.C.; Carr, M.J.; Krauss, G. (Rockwell International, Energy Systems Group, Golden, CO 80401). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **13A**: 1263-1274(Jul 1982).

Flow localization and shear band formation in a γ' strengthened austenitic stainless steel, JBK-75, was investigated by means of compression of reduced-gage-section, cylindrical specimens. The specimens were deformed in a strain rate range of 10^3 to 10^{-3} /SUB s/ $^{-1}$ and from 650 °C to 1100 °C. The alloy exhibited an extreme susceptibility for macroscopic localized flow when the microstructure contained fine γ' precipitates on the order of 10 nm. At high strain rates localized flow in th precipitate containing structures took the form of macroscopic, transgranular shear bands. At low strain rates the localized flow occurred mainly in precipitate-free zones along high angle grain boundaries. Localized flow was always associated with the occurrence of dynamic recrystallization. Other mechanisms for flow localization, including the effects of adiabatic heating on γ' precipitate dissolution, are discussed.

56040 Lack of hardening in drawn bars of copper and aluminum in tension tests. Thomsen, E.G. (Univ. of California, Berkeley); Holthuis, J.T.; Thomsen, H.H. *Journal of Engineering Materials and Technology;* **104**: 227-233(Jul 1982).

Oxygen-free copper, 6061 aluminum, and 1100 aluminum bars were drawn from various initial diameters in the annealed state to bars of 11.8 mm (0.464 in.) at maximum reductions in area up to 79.5 percent. It was found that an apparent lack of hardening existed at the higher strains up to the maximum investigated as was determined in tension tests of the drawn bars. The lack of hardening observed was thought to be due, at least in part, to the development of microcracks at the larger strains, at theory proposed by Shaw. It was also found that the oxygen-free copper of the two different heats had appreciable variations in ductility at fracture in tension tests. The reason for this behavior was not determined.

56041 Hydrogen and deuterium diffusion in vanadium alloys. Herro, H.M. Ames, IA; Iowa State Univ. (1982). 54p. University Microfilm Order No. 82-21,193.

Thesis (Ph.D.).

Hydrogen and deuterium diffusion coefficients were measured between 473 and 230 K in alloys of vanadium containing titanium or niobium. Boltzmann-Matano techniques allowed the measurement of the hydrogen concentration dependence of the diffusion coefficient. In addition, one of these techniques permitted a determination of the terminal hydrogen solid solubility which was greatly increased by alloying. Both the hydrogen and deuterium diffusion coefficients were found to decrease with hydrogen isotope concentration in all alloys at all temperatures. The effect of niobium additions was to markedly reduce the rate of hydrogen migration to a minimum in the 75 at. pct. Nb alloy. The rate of hydrogen migration decreased with titanium concentration up to 30 at. pct. Ti, the highest concentration examined in that alloy system. The diffusion coefficients exhibited an Arrhenius temperature dependence and the resulting diffusion activation energy and D/sub o/ values both increased with titanium and with niobium concentration to a maximum of 75 at. pct. Nb. Deuterium diffusion activation energies were larger than corresponding hydrogen values in all alloys. The diffusion behavior found in these alloys is not well represented by current local deep trapping models.

56042 Impact wear of a tool steel. Nowotny, H.; Rice, S.; Wayne, S. (Univ. of Connecticut, Storrs). *Wear;* **81**: 175-181(1982). Contract AC02-81ER10910.

Results from wear studies in repetitive impact sliding are described in this paper. The material pair studied consisted of steel CPM-10V (specimen) (where CPM denotes crucible particle metallurgy) and 17-4 precipitation-hardened (PH) steel (counterface) with transverse sliding velocities of 4 and 8 m s^{-1}. By means of scanning electron microscopy, energy-dispersive analysis of x-rays and x-ray diffraction methods it is shown that the wear is due to a material transport of the counterface 17-4 PH steel to the CPM-10V surface. In the wear process, a change in microhardness of the counterface substrate is apparent, and x-ray diffraction of debris confirms the presence of transformed metal. These products include γ-Fe together with trace amounts of α-Fe_2O_3; however, virtually no carbide from the CPM-10V steel was detected.

56043 Structure of the reconstructed domains on a high density stepped W(001) surface. Wang, G.C. (Oak Ridge National Lab., TN); Lu, T.M. *Surface Science;* **122**: L635-L641(1982). Contract W-7405-ENG-26.

We have observed, using low-energy electron diffraction, the reconstructed ($\sqrt{2}$ x $\sqrt{2}$) R45° structure on a high density stepped W(001) surface (~ 28 A average terrace width) cooled below room temperature. The reconstructed domains are preferentially oriented with the zig-zag displacements of the surface atoms perpendicular to the step edge which is parallel to the (110) direction. The step edges are found to inhibit the reconstruction for a considerably smaller range than reported from previous LEED observations.

56044 Effects of radiation on materials. Brager, H.R.; Perrin, J.S. (eds.). Philadelphia, PA; American Society for Testing and Materials (1982). 1237p. (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

Seventy-one papers are grouped under the following headings: creep and swelling, pressure vessel steels, microstructural development, mechanical properties, charged-particle irradiation, theory of radiation effects, and invited speeches (TMI-2 accident, and fusion and FBR materials programs). Separate abstracts have been prepared for 51 of the papers; the remainder have been previously abstracted. (DLC)

56045 Swelling behavior of 20% CW 316 stainless steel cladding irradiated with and without adjacent fuel. Makenas, B.J. (Hanford Engineering Development Lab., Richland, WA); Bates, J.F.; Jost, J.W. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 17-29(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

Swelling behavior has been evaluated for irradiated 20% CW 316 stainless steel used as cladding material for mixed-oxide fuel pins in EBR-II. This behavior has been compared statistically with the behavior of a large number of specimens which were irradiated without adjacent fuel in the same reactor. In spite of the chemical environment and stresses experienced by fueled cladding, the fueled and nonfueled cladding appear to behave in a similar manner although some divergence was noted for one of the cases studied.

56046 Initial results of swelling and irradiation creep interaction testing. Foster, J.P. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 44-70(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

An EBR-II irradiation test, designated as WSA-60, was established to provide swelling and irradiation creep interaction data when these two effects interact simultaneously in opposition. This type of behavior occurs under irradiation in cylindrical tubing containing an internal heat source and external heat sink. The WSA-60 test consists of encapsulated fuel pins wherein the capsules comprise the test samples. Slit tube data have been obtained on two 20% cold-worked AISI 316 stainless steel capsules irradiated to a peak fluence level of 2.2 x 10^{22} n/cm^2 (E > 0.1 MeV). The capsules were irradiated to approximately the same fluence level and had similar temperature profiles. The slit tube data from the two capsules were observed to be self-consistent. Since the data are limited to low fluence levels where swelling is negligible the material behavior is dominated by irradiation creep effects. An assessment of the slit tube data was made by comparing the data with performance calculations using an irradiation creep equation formulated from pressurized tube data. The results show significant differences between the slit tube data and the calculations. A 34% reduction in irradiation creep was necessary to obtain consistency between the data and calculations. This difference is attributed to the following: (1) differences in material compositions between the slit tube and pressurized tube specimens; (2) the analytical methods used in irradiation creep equation development.

58047 **Microstructural changes in neutron-irradiated commercial alloys: a sequel.** Bell, W.L. (General Electric Co., Pleasanton, CA); Lauritzen, T. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 139-151(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The effect of reactor irradiation on the microstructural stabilities of several high-nickel-content superalloys was evaluated by transmission electron microscopy. The alloys include Nimonic PE16 and the Inconel alloys 706 and 718. Specimens were irradiated in sealed, unstressed, sodium-filled capsules in the EBR-2. Irradiation temperatures ranged from 399 to 649°C (750 to 1200°F); specimens accumulated a peak fluence of 6 x 10^{22} n/cm^2, E > 0.1 MeV. While little or no microstructural changes were observed in Nimonic PE16, the Inconels exhibited overaging precipitation effects - in particular, the formation of the stable overaging precipitate, eta - which increased with temperature in the range studied. Inconel 706 exhibited the more pronounced overaging effects, i.e., larger and coarser eta plates, consistent with its higher Ti/Al ratio. In general, the precipitation features noted in all three alloys were similar to those observed in identical material after ion bombardment with high energy nickel. The ion bombardment work has thus correctly predicted the microstructural response of these alloys to fast neutron irradiation.

58048 **Effect of helium on swelling in stainless steel: influence of cavity density and morphology.** Stoller, R.E.; Odette, G.R. (Univ. of California, Santa Barbara). *American Society for Testing and Materials, Special Technical Publication;* No. 782, 275-294(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The interaction of displacement damage and transmutant helium is thought to be an important factor in the evolution of cavity microstructures. A plausible sequence of events involves the growth of bubbles to a critical size or critical number of helium atoms. Above this critical size, determined by the local point defect fluxes, the cavities grow rapidly as voids. Cavities growing at matrix-precipitate interfaces convert to voids at a lower helium content than matrix cavities due to surface energy and other effects. Such precipitate-associated voids are the major source of swelling in austenitic stainless steels in fast reactors. Because of several competing mechanisms, the increased helium to displacement (He/dpa) ratios characteristic of fusion and mixed-spectrum fission reactors can lead to either significant increases or decreases in net cavity swelling when compared with fast reactors. Cavity density is believed to be a critical factor and it is increased at higher He/dpa ratios. We use a calibrated rate theory swelling model to examine the combined effect of cavity density and helium generation rate; the influence of precipitates is also modeled. At very high cavity densities, which may be produced at high He/dpa ratios, a bifurcation in the swelling path is observed: precipitate-associated voids give way to matrix bubbles and reduced swelling. At lower cavity densities swelling is enhanced at higher helium levels, primarily due to reduced incubation exposures. Most significantly, the theory predicts nonmonotonic swelling behavior as a function of the He/dpa ratio. These results have important implications with respect to use of fast spectrum (low He/dpa ratio) and mixed-spectrum (high He/dpa ratio) fission reactor data to predict swelling in fusion spectra at intermediate He/dpa ratios. Indeed, the model suggests the peak swelling is near the fusion He/dpa ratio for some austenitic stainless steels.

58049 **Kinetics of annealing of irradiated surveillance pressure vessel steel.** Harvey, D.J. (Boston Edison Co., MA); Wechsler, M.S. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 505-519(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

Indentation hardness measurements as a function of annealing were made on broken halves of Charpy impact surveillance samples. The samples had been irradiated in commercial power reactors to a neutron fluence of approximately 1 x 10^{19} neutrons per cm^2, E > 1 MeV, at a temperature of about 300°C (570°F). Results are reported for the weld metal, which showed greater radiation hardening than the base plate or heat-affected zone material. Isochronal and isothermal anneals were conducted on the irradiated surveillance samples and on unirradiated control samples. No hardness changes upon annealing occurred for the control samples. The recovery in hardness for the irradiated samples took place mostly between 400 and 500°C. Based on the Meechan-Brinkman method of analysis, the activation energy for annealing was found to be 0.60 +- 0.06 eV. According to computer simulation calculations of Beeler, the activation energy for migration of vacancies in alpha iron is about 0.67 eV. Therefore, the results of this preliminary study appear to be consistent with a mechanism of annealing of radiation damage in pressure vessel steels based on the migration of radiation-produced lattice vacancies.

56050 **Irradiation embrittlement in some austenitic superalloys.** Vaidyanathan, S. (General Electric Co., Sunnyvale, CA); Lauritzen, T.; Bell, W.L. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 619-635(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The nature of the irradiation embrittlement phenomenon in selected austenitic superalloys was evaluated in tubular specimens compression tested at elevated temperatures. Materials included the commercial alloys Inconel 706 and Nimonic PE-16 and two experimental alloys. All are precipitation hardenable and were irradiated from 2.8 to 7.1 x 10^{22} n/cm^2 (E > 0.1 MeV). The tests revealed marked ductility losses in all alloys, the most severe embrittlement occurring at 110°C above the temperature at which the materials were irradiated. In some instances, zero ductility was recorded. The testing further revealed that short-term post-irradiation heat treatments produced moderate to high levels of ductility recovery without significant losses in strength. Extensive scanning and transmission electron microscopy examinations have indicated that the low ductility behavior is associated with intergranular fracture and the copious precipitation of γ' along or adjacent to grain boundaries. Based upon these results it is concluded that the principal cause of embrittlement in these alloys is the precipitation of γ' along grain boundaries during irradiation. The segregation of silicon in addition to titanium and aluminum is considered a major factor in the embrittlement mechanism.

56051 Nickel-doped ferritic (martensitic) steels for fusion reactor irradiation studies: tempering behavior and unirradiated and irradiated tensile properties. Klueh, R.L.; Vitek, J.M.; Grossbeck, M.L. (Oak Ridge National Lab., TN). *American Society for Testing and Materials, Special Technical Publication;* No. 782, 648-664(1982). (CONF-820628—). Contract W-7405-ENG-26.

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

When an alloy containing nickel is irradiated in a mixed-spectrum reactor, helium is produced in the lattice by the transmutation of ^{58}Ni by thermal neutrons. Nickel doping of two ferritic (martensitic) steels is being used to determine the effect of simultaneously produced helium and displacement damage (produced by the fast neutrons in the spectrum) on the mechanical properties of these steels, which are structural candidates for fusion reactor applicatioans. Heats of 9 Cr-1 MoVNb and 12 Cr-1 MoVW with up to 2% Ni have been prepared. Tempering studies were conducted to determine the effect of nickel on the basic alloys and to identify the appropriate tempering temperature and time. Tensile specimens of the steels were irradiated in the High Flux Isotope Reactor to displacement damage levels of up to 9.3 dpa and helium concentrations of up to 82 at. ppM. Tensile studies at room temperature and 300°C on the 9 Cr-1 MoVNb steels indicated that the irradiation led to increased strength and decreased ductility compared to the steels in the unirradiated condition. It was concluded that the hardening resulted from the displacement damage and was not affected by the transmutation helium. Results were similar to tensile properties previously obtained for nickel-doped 12 Cr-1 MoVW steel irradiated under similar conditions. 13 figures.

56052 Deformation microstructure developed during fatigue crack propagation in Type 316 stainless steel at 593°C. Michel, D.J.; Smith, H.H. (Naval Research Lab., Washington, DC). *American Society for Testing and Materials, Special Technical Publication;* No. 782, 690-700(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The failure modes and dislocation substructure produced by fatigue crack propagation at 593°C in fast neutron irradiated and unirradiated Type 316 stainless steel were studied. The results indicate that the dislocation substructure produced by the crack propagation during both cyclic and combined cyclic-static loading conditions was directly dependent on the extent of matrix deformation as reflected by the mode of crack propagation. The results are consistent with the activation of either grain boundary or matrix mechanisms for deformation, as related to loading conditions, at the temperature investigated. The influence of neutron irradiation was to alter the operation of the basic deformation mechanisms by the increased difficulty of matrix dislocation motion resulting from the irradiation-induced defect production.

56053 Void swelling of ferritic alloys bombarded with nickel ions. Johnston, W.G. (General Electric Corporate R and D, Schenectady, NY); Lauritzen, T.; Rosolowski, J.H.; Turkalo, A.M. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 809-823(1982). (CONF-820628—). Contract AT03-76SF71031.

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The dependence of swelling on temperature, dose and composition of simple ferritic alloys bombarded with 5-MeV Ni ions has been investigated. The peak swelling temperature of 550°C (1022°F) is 125°C (257°F) lower than for low nickel austenitic alloys. The swelling in ferritic alloys is at least an order of magnitude less than in the high swelling, low Ni, austenitic alloys. However, the swelling of simple ferritic alloys at 116 dpa overlaps that in about 40% of the austenitic phase field. The variation of swelling with temperature is due to changes in both void size and void density. The increase in swelling with dose, and the variation with Cr content, are due to the variation in void size. However, the reduction of swelling with Ni addition is due to a reduction in void density, so there is a major qualitative difference in the way Ni and Cr affect the swelling. The voids in ferritic alloys are cube-shaped in contrast to the truncated octahedra in austenitic alloys. The sharp reduction in swelling by Ni indicates that, at high doses, the implanted Ni will lead to errors in the swelling data. It is judged that the semi-quantitative conclusions drawn from the present work are not seriously compromised by the effects of implanted nickel.

56054 Effect of pulse irradiation on void swelling of a pure 316 stainless steel. Miyahara, K. (Univ. of Tokyo, Japan); Packan, N.H.; Igata, N. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 941-952(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The effect of pulse irradiation on the swelling of Fe-17Cr-17Ni-2.5Mo alloy has been investigated in the present work. Ion species are 4 MeV Ni^{++} and 0.2 to 0.4 MeV He^{+}. Irradiation temperatures were 843 and 1023K. Pulsing irradiation is used in the series of 0.5s beam on/0.5s beam off (fast pulse) or that of 60s beam on/60s beam off (slow pulse). In the case of no He injection, the pulse irradiation suppreased completely the formation and growth of cavities at the irradiation temperature of 1023K. For the case of He preinjection at the higher irradiation temperatures, the pulse irradiation restrained the growth of cavities but increased the number density of cavities. The effect of dual beam pulse irradiation at 843K was small. The other interesting effect of pulse irradiation at 1923K was to inhibit the occurrence of bimodal distributions of cavities (suppressing the large ones) which are otherwise observed with either He preinjection or simultaneous injection.

56055 Effect of radiation-induced segregation on void nucleation. Si-Ahmed, A. (Centre des Sciences et de la Technologies Nucleaires, Algiers, Algeria); Wolfer, W.G. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 1008-1022(1982). (CONF-820628—). Contract AC02-78ER04861.

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

The effect of segregation on void nucleation is investigated utilizing previous results for the capture efficiency of coated void. First, it is shown that any segregation, whether or not it leads to actual precipitation, leads to a modification of the bias factors for any sink. Small increases of either the lattice parameters or the elastic moduli result in reduced interstitial bias factors. Second, segregations to void embryos not only changes their capture efficiencies but also the surface energy. The effect of these changes on the void nucleation rate is studied in quantitative terms. When the segregation to voids results in an increase of the local lattice parameters by 0.4% or an increase of the shear modulus by 3%, the ultimate void nucleation rate is reached. Further increases no longer enhance void nucleation. Void nucleation without segregation effects would only be possible if the dislocation bias exceeds 50%. With segregation, void nucleation is not strongly dependent on the dislocation bias.

56056 Radiation-induced segregation and the compositional dependence of swelling in Fe-Ni-Cr alloys. Wolfer, W.F. (Univ. of Wisconsin, Madison); Garner, F.A.; Thomas, L.E. *American Society for Testing and Materials, Special Technical Publication;* No. 782, 1023-1041(1982). (CONF-820628—). Contract AC02-78ER04861;AC06-76FF02170.

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

When alloys based on the Fe-Ni-Cr system are subjected to irradiation at high temperatures a substantial amount of elemental segregation occurs. Two categories of segregation have been observed, one involving radiation-induced precipitation or changes in precipitate composition, and another involving the establishment of compositional gradients near microstructural sinks. While segregation into precipitate phases is known to strongly influence the development of void swelling, it now appears that segregation to void surfaces plays an equally important role of nickel as a primary segregant. An investigation of the basic flux equations for diffusion of

interstitials and vacancies in superimposed strain and composition gradients shows that several previously unconsidered drift terms arise in the description of the bias as a result of elemental segregation. These terms originate from the compositional dependence of point defect formation and migration energies and the compositional dependence of elastic properties and lattice parameter. When compounded with the operation of the inverse Kirkendall segregation mechanism, these terms strongly alter the bias for void nucleation and growth and provide an explanation for the marked variation of void nucleation and swelling with nickel concentrations. The segregation-induced drift terms are comparable in magnitude to the strain-induced drift terms and are strongly dependent on nickel concentration. This is demonstrated for binary Fe-Ni alloys using published tracer diffusion and thermodynamic data.

56057 **Asymmetric dislocation/point-defect interactions and the modeling of void swelling.** Liu, Y.Y.; Nichols, F.A. (Argonne National Lab., IL). *American Society for Testing and Materials, Special Technical Publication;* No. 782, 1088-1102(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

An internally consistent model has been developed for analyzing void swelling during irradiation. The model employs Wigner-Seitz cells around each type of sink, namely dislocation lines, voids, and grain boundaries. Uniform generation of vacancies and interstitials is accounted for, as is diffusion in response to both concentration and radial interaction field gradients. The cells are coupled by equating concentrations and current flows at their peripheries, for arbitrary densities of the various types of sinks. A procedure has been developed for obtaining the best radial interaction fields to replace the actual angularly dependent ones surrounding dislocations. Analytical theoretical support for the chosen value (-1/4 of the average of the square of the actual field) has been developed. Quantitative accuracy has been assessed by comparison with numerical studies employing full angular dependence. The predicted swelling-rate bias factor of ~ 50% is in excellent agreement with available swelling-rate data when one assumes that ~ 16% of the defects initially generated escape close-pair recombination within the cascade. Reasonable theoretical support exists for this survival fraction.

56058 **Griffith crack shielded by a dislocation pile-up.** Majumdar, B.S.; Burns, S.J. (Univ. of Rochester, NY). *International Journal of Fracture;* vp(1982). Contract AC02-81ER10856.

The dislocation-free zone at the tip of a mode III shear crack is analyzed. A pile-up of screw dislocations parallel to the crack front, in anti-plane shear, in the stress field of a crack has been solved using a continuous distribution of dislocations. The crack tip remains sharp and is assumed to satisfy Griffith's fracture criteria using the local crack tip stress intensity factor. The dislocation pile-up shield the sharp crack tip from the applied stress intensity factor by simple addition of each dislocation's negative contribution to the applied stress intensity value. The analysis differs substantially from the well known BCS theory in that the local crack tip fracture criteria enters into the dislocation distributions found.

56059 **Observations of fracture surface chemistry on Cu-0.5 at. % Sb bicrystals.** Chuang, T.H. (Max-Planck-Institut, Stuttgart, Germany); Gust, W.; Heldt, L.A.; Hintz, M.B.; Hofmann, S.; Lucic, R.; Predel, B. *Scripta Metallurgica;* 16: No. 12, 1437-1441(1982). Contract AC02-81ER10941.

For a given segregation heat treatment, the fracture mode of Cu-0.5 at. % Sb bicrystals is dependent upon intercrystalline misorientation. From the present data it cannot be determined if this behavior is a result of differences in segregant level alone or if other misorientation dependent interfacial properties are significant as well. Specimens having the same misorientations and thermal histories are observed to have relatively constant fracture surface chemistries. This implies that the fracture path through an interface of a particular type is well defined in the Cu-Sb system.

56060 **Discontinuous creep in short-range order alloys.** Klueh, R.L. (Oak Ridge National Lab., TN). *Materials Science and Engineering;* 54: 65-80(1982). Contract W-7405-ENG-26.

A discontinuous creep process has been observed in creep studies on several complex commercial nickel-base alloys that contain chromium and an experimental binary Ni-20 wt % Cr alloy. Instead of a continuous strain-time creep curve as is normally observed, creep tests on these alloys exhibited an instantaneous elongation or strain burst, where the creep curves contained strain jumps. The studies showed that the process did not depend on gross metallurgical changes in the microstructure or on a precipitation process. It was postulated that the strain bursts are related to the formation of dislocation pile-ups in the matrix. When a localized pile-up breaks through a barrier, a dislocation avalanche results that triggers neighboring pile-ups. This process continues in neighboring grains and gives rise to the propagation of a deformation band along the gauge length in a Lueders-type deformation. It was demonstrated how the pile-up barriers could involve short-range order.

56061 **Annealing of defects produced by neutron irradiation.** McHargue, C.J. (Oak Ridge National Lab., TN). *International Metals Reviews;* 27: No. 3, 121-139(1982). Contract W-7405-ENG-26.

The literature on the recovery of irradiation-produced changes in microstructure and mechanical properties is reviewed for irradiation temperatures above 0.1 T/sub m/. There has been little effort applied to model the annealing processes in spite of the large number of experimental observations. Many studies have recognized the strong influence of interstitial impurities on recovery, but the possible influence of substitutional impurities trapped at defect clusters or segregated to defects such as voids has not been considered in detail. Incomplete description of complex defect configuration hampers progress toward a unifying model. 134 references, 17 figures, 3 tables.

56062 **Leed study of the (100) and (111) surfaces of the intermetallic compound FeTi.** Felter, T.E. (Sandia National Labs., Livermore, CA); Steward, S.A.; Uribe, F.S. *Surface Science;* 122: 69-79(1982). Contract W-7405-ENG-48;AC04-76DP00789.

Two single crystals of FeTi, an intermetallic compound with a CsCl cubic structure, have been isolated from a bulk melt. After numerous cycles of concurrent argon bombardment and heating to at least 1200 K, clean and well-ordered surfaces appeared on both crystals, as determined by Auger electron spectroscopy (AES) and low energy electron diffraction (LEED). The first crystal produced a hexagonal pattern after heating to 1400 K. The measured lattice parameter is $a_0 = 4.3 +- 0.2$ A compared to 4.2 A, which is the reported x-ray value for the (111) plane of FeTi. The second crystal became ordered at a lower temperature (1200 K) showing a square pattern corresponding to FeTi(100). The lattice parameter calculated from LEED was 3.1 +- 0.15 A, again in good agreement with x-ray data of 3.0 A. Sulfur readily segregates to the surface above 1000 K and orders to produce a c(2 x 2) pattern on the (100) face. This is the first observation of an ordered overlayer on an intermetallic compound.

56063 **HVEM study of radiation-induced segregation in dilute Ni-Be alloys.** Mukai, T.; Mitchell, T.E. (Case Western Reserve Univ., Cleveland, OH). pp 950-953 of Point defects and defect interactions in metals. Tokyo, Japan; University of Tokyo Press (1982). Contract AC02-76ER02119.

High voltage electron microscopy has been used for in-situ observations of precipitation in undersaturated solid solutions of Ni-1 at % Be alloys under electron irradiation. The results show that the precipitation follows the normal ageing sequence of saturated solid solutions without irradiation: G.P. zones $\rightarrow \gamma'' \rightarrow \gamma'$. At the beginning of irradiation, the precipitation is homogeneously induced. Later on dislocation loops of interstitial type nucleate at precipitates. Most of the loops lie on [100] planes, having a <100> Burgers vector. Longer irradiations produce dislocation tangles containing precipitates. In thin specimen regions, however, faulted Frank loops form after <100>/[100] loops disappear.

56064 Defect structures in β-niAl and their response to electron irradiation. Liu, H.C.; Mukai, T.; Mitchell, T.E. (Case Western Reserve Univ., Cleveland, OH). pp 635-638 of Point defects and defect interactions in metals. Tokyo, Japan; University of Tokyo Press (1982). Contract AC02-76ER02119.

Defect structures in β-NiAl alloys were studied by TEM. Diffuse rings of intensity maxima have been observed in diffraction patterns of both Ni-poor and Ni-rich NiAl, providing evidence for short-range ordering of structural point defects in β-Ni/sub 1 +- x/ Al. Furthermore, diffuse streaks along <110> and <112> directions are also observed in diffraction patterns of 50, 55, 58 and 60 at % Ni alloys. These diffuse streaks are related to pre-martensitic instabilities of Ni-rich NiAl. Electron irradiation by HVEM was found to destroy the short-range order. Irradiation of 50, 55 and 58 at % Ni specimens at 700°K created high densities of <001>[001] interstitial loops, but only created a low density of small defect clusters in 46 at % Ni specimen. This is interpreted in terms of recombination of radiation-induced interstitials with the high concentration of structural Ni vacancies in Ni-poor NiAl.

56065 Use of surface analytical techniques to examine metal corrosion problems. Baer, D.R.; Thomas, M.T. (Pacific Northwest Lab., Richland, WA). *ACS Symposium Series;* No. 199, 251-282(1982). Contract AC06-76RL01830.

The applications of several surface analytical techniques to the solution of corrosion problems are reviewed in this paper. The use of surface techniques in corrosion work is increasing both because the methods are more widely available than previously and because the techniques themselves are being refined. However, the application of these methods to particular corrosion problems is not always straightforward and care must be taken to match the use of any method to the specific problem. Some general guidelines concerning the applicability of surface tools are discussed before several examples of their application are given. Techniques discussed include: x-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), Rutherford backscattering (RBS) and nuclear reaction spectroscopy.

56066 Fine structure of track-plated Au-Cu alloy. Johnson, K.A.; Staudhammer, K.P. (Los Alamos National Lab., NM). *Proceedings - Annual Meeting, Electron Microsopy Society of America;* 524-525(1982).

The burnishing process, i.e., mechanical rubbing of the deposit during electrodeposition, produces continuous nucleation of new grains during deposition which effectively prevents large columnar grains and macroporosity. In addition, track plating produces a uniform subgrain and substructure. By the use of STEM and TEM we were able to define a number of structural features of this material. Evident from the micrographs is the non-uniform polishing of the layers resulting from the chemical variation in the plating process. Microstructural features of the Au rich regions are shown. The unit size of this structure is about 22 nm. The fine-grained structure does not have well defined boundaries but does contain a slight amount of preferred alignment. Each equivalent unit has periodic fine structure measurable to ~ 2 nm.

56067 A TEM study of low temperature shock induced α'-martensite in 304 stainless steel. Staudhammer, K.P. (Los Alamos National Lab., NM); Murr, L.E. *Proceedings - Annual Meeting, Electron Microsopy Society of America;* 482-483(1982).

This study demonstrates that shock-loaded 304 stainless steel transforms at very low temperature by a stress-assisted nucleation, or different types of strain-induced mechanism.

56068 Microstructure of explosively loaded 304 stainless steel flyer plate. Johnson, K.A. (Los Alamos National Lab., NM); Staudhammer, K.P.; Murr, L.E. *Proceedings - Annual Meeting, Electron Microsopy Society of America;* 480-481(1982).

A 304 SS flyer plate 0.54 cm thick was driven at 25 GPa at 2 μsec pulse duration. A figure illustrates the increase in hardness through the plate thickness. The higher hardness occurs at the bottom of the flyer plate. Stain-induced α'-martensite morphology was obtained in the 304 specimen, just below the flyer plate from the same impact. The flyer plate microstructures from top to bottom show an increase in α'-martensite as well as a significant increase in the residual dislocation densities. The α'-martensite within the flyer plate for the most part is strain-induced and is observed to coalesce into laths along the <110>, in addition to being observed in a blocky structure.

56069 Chemisorption of hydrogen on titanium: embedding theory and comparisons with small clusters. Cremaschi, P.; Whitten, J.L. (State Univ. of New York at Stony Brook). *Surface Science;* **112**: 343-358(1981). Contract AC02-77ER04387.

The chemisorption of H_2 on Ti(0001) is treated using an ab initio CI theory for the surface region. Dissociation of H_2 occurs above the surface but more stable 3-fold coordination sites lie closer to the surface at ~1.3 angstrom. Adsorption in adjacent 3-fold sites is less stable than in separated sites sharing ony one surface atom. The calculated adsorption energy of 45 kcal/mol H_2 compares favorably with experiment. Bonding involves mainly the 4s electrons of the metal leading to hydridic hydrogens and a polarized lattice electron distribution, but d bonding and correlation effects significantly increase the binding energy. Calculations on small metal clusters also show dissociative adsorption but much larger hydrogen binding energies are obtained.

56070 Microstructure and properties of commercial grade manganese zinc ferrites. Tsunekawa, H. (TDK Electronics Co., Chiba, Japan); Nakata, A.; Kamijo, T.; Okutani, K.; Mishra, R.K.; Thomas, G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-15**: No. 6, 1855-1857(Nov 1979).

The microstructures of differently processed Commercial grade MnZn soft ferrites have been studied using transmission electron microscopy and microanalysis, and the microstructural features correlated with the magnetic properties. Special emphasis has been placed on the grain boundaries. The permeabilities range from 1200 to 18,000 and loss factors ($\tan\delta/\mu$) from 1.0×10^{-6} to 13.7×10^{-6} at 50 kHz. The pore distribution in these ferrites was quite diverse although the total porosities are nearly the same. In specimens of low μ either the defect density was high or varying amounts of an amorphous phase were observed at the grain boundaries. In these samples STEM X-ray analyses revealed the presence of Ca and Si in the thin grain boundary phase. Also, in some specimens the presence of Fe_2O_3 and/or MnO_2 precipitates at some grain junctions was observed. In the high μ ferrites, few defects and no intergranular phases were observed, and Ca could not be detected. It is suggested that the lattice distortion associated with the amorphous phase and the boundary segregation reduces the permeability.

56071 Residual-stress measurements on multi-pass weldments of stainless-steel piping. Ellingson, W.A.; Shack, W.J. (Argonne National Lab., IL). *Experimental Mechanics;* **19**: No. 9, 317-323(Sep 1979).

This paper presents measurements of the bulk residual stresses in 100-mm (4-in.) and 250-mm (10-in.) diam Schedule 80 piping weldments using strain-relief techniques. Both laboratory-welded specimens and field-welded specimens from reactors in service were studied. Axial bulk residual-stress distributions were obtained at 45-deg intervals around the circumference. At each azimuthal position, the residual stresses were measured at seven axial positions: on the weld center line and 13, 20 and 25 mm to either side of the weld center line, on both the inside and outside surface. The specimens were parted out using a wire-feed electric-discharge machine, and the resulting strain relief was measured with electrical-resistance strain gages (120-deg rosettes). The bulk residual stresses obtained on the inside surface of the 100-mm weldments exhibit an oscillatory distribution with peak values above 275 MPa (40 ksi) and stress gradients normal to the weld on the order of 35 MPa/mm (127 ksi/in.).

56072 How brittle is brittle fracture?. Nichols, F.A. (Argonne National Lab., IL). *Engineering Fracture Mechanics;* **12**: No. 3, 307-316(1979).

A critical survey is given of what appear to be the basics of the field of fracture mechanics. The survey is certainly not exhaus-

tive and is approached from the viewpoint and with the pre-suppositions of a "materials" as opposed to a "mechanics" person. Some apparent shortcomings, limitations and misconceptions in the field as generally practiced are discussed in deliberately provocative terms, with a sincere plea for feedback from those with differing views. Finally, some topics are suggested which appear to the author to be fruitful areas for future research in the fracture of metals.

56073 **Hold-time sequence effects on the elevated-temperature low-cycle fatigue of Type 304 stainless steel.** Majumdar, S.; Maiya, P.S. New York, NY; The American Society of Mechanical Engineers (1978). 8p. (CONF-781202—). American Society of Mechanical Engineers, 345 E. 47th St., New York, NY, $3.00.

From ASME meeting; San Francisco, CA, USA (10 Dec 1978).

Low-cycle-fatigue test data on Type 304 stainless steel at 593 C, involving a predetermined number of cycles with tensile hold time followed by cycles with or without compressive hold time to failure and vice versa, are presented. The fatigue-fracture surface of each test specimen has been studied by means of scanning-electron microscopy. The results show that the sequence of hold times has a significant effect on the fatigue-fracture surface appearance. A 10-min. tensile hold per cycle to failure produced a predominantly intergranular fracture; however, when a 4-min. compressive hold per cycle was introduced after the specimen had experienced 10-min. tensile-hold cycles for ~80 percent of the life expected under such a loading the fracture mode became predominantly transgranular with well-developed striations on the fracture surface. This behavior is analyzed in terms of the damage-rate approach, which assumes that the cavity damage produced during tensile-hold cycles can be annealed out during subsequent compressive hold cycles.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 55566, 55755, 55987, 56166

56074 **(BMFT-FB-T—83-161) Optimization of SiC-based materials.** Lorenz, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1983. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83751348.

With 26 refs., 11 tabs., 34 figs.

Because of its very strong covalent bonds, silicon carbide shows almost ideal brittle fracture. Dispersions of ZrO_2 and HfO_2 in the SiC-matrix were used in order to achieve a better toughness of the material due to the martensitic transformation toughening mechanism. The preparation of the samples was done by hot-pressing powder mixtures. ZrO_2- and HfO_2-dispersions could be chemically stabilized in the matrix by the additives SiO_2 and Al_2O_3. An optimum in surface hardness and fracture toughness could be achieved. The influence of the additives on thermal expansion coefficient and oxidation resistance of the material was studied.

56075 **(CONF-820935—11) Neutron-scattering studies of magnetic superconductors.** Sinha, S.K.; Crabtree, G.W.; Hinks, D.G.; Mook, H.A.; Pringle, O.A. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE84000393.

From 6. Yamada conference on neutron scattering of condensed matter; Tokyo, Japan (1 Sep 1982).

Results obtained in the last few years by neutron diffraction on the nature of the magnetic ordering in magnetic superconductors are reviewed. Emphasis is given to studies of the complex intermediate phase in ferromagnetic superconductors where both superconductivity and ferromagnetism appear to coexist.

56076 **(CONF-820945—13) Structural alterations in SiC as a result of Cr^+ and N^+ implantation.** Williams, J.M.; McHargue, C.J.; Appleton, B.R. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE84000642.

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

Ion scattering and channeling techniques were used to study production of disorder and randomization of SiC by implantation of Cr^+ and N^+ at doses of up to 3 x 10^{16} /cm^2 for Cr^+ and 8 x 10^{16} / cm^2 for N^+. Experiments were designed so that the calculated damage energy profiles would be well matched for the two ion species. The results were compared for the degree of effectiveness of Cr^+ and N^+ in producing disorder. At higher doses, Cr^+ was much more effective than N^+ for a given damage energy using the same calculational method for Cr^+ as for N^+. In correlated studies of swelling, both species had about the same effectiveness in producing swelling.

56077 **(LA-UR—83-2775) Effects of superconductivity on rare-earth-ion dynamics in (Ho/sub x/Lu/sub 1-x/)Rh_4B_4.** Heffner, R.H.; Cooke, D.W.; Hutson, R.L.; Leon, M.; Schillaci, M.E.; Smith, J.L.; Yaouance, A.; Dodds, S.A.; Gupta, L.C.; MacLaughlin, D.E. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 15p. (CONF-831187—4). NTIS, PC A02/MF A01. Order Number DE84001319.

From MMM conference; Pittsburg, PA, USA (8 Nov 1983).

The temperature dependence of the Ho-ion fluctuation rate tau/sub m/$^{-1}$ in the pseudoternary compound Ho/sub x/Lu/sub 1-x/Rh_4B_4 is obtained using the zero-field muon spin relaxation technique, primarily for x = 0.02. A sharp reduction in the magnitude and a change in the temperature dependence of tau/sub m/$^{-1}$ occur at the superconducting transition temperature T/sub s/. Above T/sub s/ the temperature dependence of tau/sub m/$^{-1}$ can be attributed to an activated relaxation process, whereby fluctuations occur by excitation to the first few crystal-field-split states. Neither the temperature dependence nor the sharp change in tau/sub m/$^{-1}$ at T $\leq$ T/sub s/ are presently understood. The data are contrasted with the recent NMR data of Kumagai and Fradin for dilute Gd- and Er-based rhodium borides, which have very different crystal-field-induced level schemes from Ho/sub x/Lu/sub 1-x/Rh_4B_4.

56078 **(MDC-E—2677) Lithium-based oxide ceramics for tritium-breeding applications.** Suiter, D.J. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). Jun 1983. Contract W-31-109-ENG-38. 118p. NTIS, PC A06/MF A01. Order Number DE84000448.

Material preparation techniques, crystallographic data, phase diagrams, metal compatibility, and thermal properties have been assembled for the lithium-based oxide ceramics designated as potential solid tritium breeders for fusion devices. The materials discussed in this report include: Li_2O, β-Li_5AlO_4, γ-$LiAlO_2$, Li_4SiO_4, Li_2SiO_3, Li_4TiO_4, Li_2TiO_3, Li_8ZrO_6, Li_4ZrO_4, and Li_2ZrO_3. The thermal properties covered were vaporization, thermal conductivity, specific heat, and linear thermal expansion. There has been no attempt to rank the above mentioned candidates, but rather to merely indicate points that must be considered when using the various materials as solid breeders. These encompass low lithium atom densities, destructive phase transformations, a higher thermal expansion, low thermal conductivity, excessive vaporization at low temperatures, corrosive nature toward metals and difficulty in sample preparation.

56079 **(SAND—83-0804C) Energy release and transformation of shock-modified zirconia upon annealing to 1550°C.** Hammetter, W.F.; Hellmann, J.R.; Graham, R.A.; Morosin, B. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830719—52). NTIS, PC A02/MF A01. Order Number DE83017801.

From American Physical Society meeting on shock waves in condensed media; Santa Fe, NM, USA (18 Jul 1983).

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The shock-modified powder samples described by Morosin et al (this meeting) have been studied in DTA measurements to 1550°C to determine the influence of shock modification on energy release and on the monoclinic to tetragonal transformation. Energy release over that of control samples is observed to begin at ~ 200°C and continues to the onset of the transformation. The phase transformation temperature is at ~ 1170°C and is unaffected by shock-loading pressure up to 16 GPa. Above that pressure, the transformation temperature is lowered as pressure increases. The decrease in temperature correlates with both the decrease in crys-

tallite size and retention of the tetragonal phase indicated by x-ray diffraction.

56080 **(UCID—19663-83-1) Second progress report of the DARPA dynamic synthesis and consolidation program.** Cline, C.F. (ed.). (Lawrence Livermore National Lab., CA (USA)). Mar 1983. Contract W-7405-ENG-48. 416p. NTIS, PC A18/MF A01. Order Number DE84000038.

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The program activities include dynamic compaction, shock activation and combustion and plasma synthesis. The primary materials under study are the compounds AlN, Al_2O_3, TiC and TiB_2.

56081 **(UCRL—53425) Plutonium doping of SYNROC-D.** Van Konynenburg, R.A.; Guinan, M.W. (Lawrence Livermore National Lab., CA (USA)). 27 May 1983. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01. Order Number DE84000987.

The purpose of this work was to perform an experimental simulation of the radiation effects that SYNROC-D (a ceramic waste form and the alternate to borosilicate glass for US defense high-level nuclear waste) will experience during the first million years of storage. Technology was developed for doping SYNROC-D with ^{239}Pu and performing external gamma irradiation to simulate both actinide and fission product decay. The doping technique was tested using both Ce and U as stand-ins to simulate the +3 and +4 oxidation states of Pu, respectively. Samples were characterized by ceramography, density measurements, x-ray diffraction, scanning electron microscope-energy dispersive x-ray analysis, electron microprobe, scanning transmission electron microscope, gamma ray spectrometry, and leaching; equipment was fabricated for dilatation measurements. An early decision by the Department of Energy (DOE) to select borosilicate glass and terminate SYNROC-D development prevented doping with ^{238}Pu or external gamma irradiation. However, a sample was doped with ^{239}Pu in order to study the Pu distribution, and characterization of this sample was completed. Although conclusive proof was not developed, all indications from this work are that Pu will go into the zirconolite and perovskite phases in SYNROC-D, favoring perovskite under the redox conditions prevailing in a graphite die. Technology development and results of Ce, U, and ^{239}Pu doping studies are described in this report.

56082 **Thermal recovery of lattice defects in alpha-irradiated UO_2 crystals.** Weber, W.J. (Pacific Northwest Lab., Richland, WA (USA)). *Journal of Nuclear Materials;* **114**: No. 2/3, 213-221(Feb 1983).

Isochronal and isothermal annealing have been used to study the recovery behavior of lattice defects in single crystals of stoichiometric UO_2 irradiated at room temperature with alpha particles emitted from an effectively semi-infinite $^{238}PuO_2$ source to a dose of $3x10^{20}$ alpha particles/m^2 (approx.=0.0625 dpa). Three recovery stages were observed in the temperature range between 50° and 1050°C. The activation energies were estimated and the recovery behavior of the lattice defects discussed.

56083 **Sintering of α-Al_2O_3--amorphous silica compacts.** Nurishi, Y.; Pask, J.A. (Lawrence Berkeley Lab., CA). *Ceramics International;* **8**: No. 2, 57-59(1982). Contract W-7405-ENG-48.

Sintering of α-Al_2O_3--fused SiO_2 compacts at temperatures of 1350 to 1500°C is affected by metastable and stable phase reactions. Shrinkage maxima in the range 10 to 30 mole % Al_2O_3 are the result of cristobalite in the fused SiO_2 and its reaction with α-Al_2O_3 to form the eutectic of the metastable phase equilibrium diagram for SiO_2 (cristobalite)--α-Al_2O_3 without mullite. The retardation of densification of α-Al_2O_3 compacts with additions of SiO_2 up to about 50 mole % at temperatures about 1400°C and above is associated with the appearance of mullite.

56084 **Work hardening and recovery in sapphire (α-Al_2O_3) undergoing prism plane deformation.** Cadoz, J. (CNRS, Meudon, France); Castaing, J.; Phillips, D.S.; Heuer, A.H.; Mitchell, T.E. *Acta Metallurgica;* **30**: 2205-2218(1982). Contract AC02-76ER01198.

Deformation of sapphire (α-Al_2O_3) by slip on the prism planes has been studied in compression. The operative slip system is [1120]<1100> but the large <1100> dislocations readily decompose into two 1/3 <2110> basal dislocations, especially at high strains. Deformation occurs in three stages: Stage I where the work hardening is low after yielding, Stage II where the work hardening rate is high ($\theta \sim \mu/40$), and Stage III where the work hardening rate decreases and leads to a plateau region. The high workhardening rate is explained in terms of the rapid formation of a forest of basal dislocations which is produced by decomposition of the prism dislocations and hinders further glide on the prism plane. The plateau region is characterized by a balance between this increase in the dislocation density and its decrease due to annihilation in the network by diffusive climb. This recovery process has been modeled by considering the network as a system of linked loops which coarsen either by bulk or pipe diffusion; the latter process is the more probable.

56085 **Diffusion and association of defects in some oxide systems.** Stubican, V.S.; Bitler, W.R.; Weber, G.W.; Osenbach, J.W. (Pennsylvania State Univ., University Park). pp 438-453 of Transport in non-stoichiometric compounds. Nowotny, J. (ed.). Warszawa, Poland; PWN-Polish Scientific Publishers (1982). Contract AC02-78ER04998.

From 1. international conference on transport in non-stoichiometric compounds; Mogilany, Poland (27 Aug 1980).

Impurities and vacancies in some oxide systems are considered to form complexes which are in equilibrium with unassociated defects. A theory has been developed which describes the relationship between the chemical and tracer diffusion coefficients of aliovalent ions in an ionic lattice. The theoretical model developed by Lidiard was used as a starting concept for the comparison between interdiffusion and tracer diffusion results. It is shown that the relationship between the chemical diffusion coefficient D and the tracer diffusion coefficient D^* is $D = 2D^*$ if the migration of dimers is the principal mechanism of transport. for the migration of trimers $D = 3D^*$ if the concentration of impurity ion is relatively small. These relationships are valid regardless of the charge of the aliovalent or lattice ion. Chemical and tracer diffusion coefficients of Cr^{3+} in Cr-doped MgO were determined for the concentration region 2.5×10^{-2} - 2.8×10^{-1} mole % Cr_2O_3. Tracer and chemical diffusion coefficients increased linearly with the concentration of Cr^{3+} or cation vacancies. For the temperature and concentration region investigated it is found that $D = (2 +- 0.17)D^*$ which indicates that diffusion proceeds primary by the migration of dimers. These results are in agreement with theory.

56086 **Diffusion and association of defects.** Stubican, V.S. (Pennsylvania State Univ., University Park). pp 454-463 of Transport in non-stoichiometric compounds. Nowotny, J. (ed.). Warszawa, Poland; PWN-Polish Scientific Publishers (1982). Contract AC02-78ER04998.

From 1. international conference on transport in non-stoichiometric compounds; Mogilany, Poland (27 Aug 1980).

This is a brief review of published work on the defects and their association and diffusion in doped AgCl, NiO, FeO, and ZrO_2-CaO. 15 references, 6 figures. (DLC)

56087 **Radiation damage in ceramics.** Mitchell, T.E.; Pascucci, M.R.; Youngman, R.A. (Case Western Reserve Univ., Cleveland, OH). pp 600-603 of 40th annual proceedings of the Electron Microscopy Society of America, Washington, DC. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982).

This article assesses the present understanding of radiation damage in ceramics with illustrations using results obtained from the authors' work. Both in situ electron irradiation damage studies and ex situ neutron irradiation damage studies are described. Experimental observations are discussed on some simple structural oxide ceramics (MgO and Al_2O_3), some more complex double oxides ($MgAl_2O_4$ spinel and Yttrium Aluminum Garnet), a non-oxide ceramic (β-Si_3N_4) and finally quartz (SiO_2) which is susceptible to radiolysis.

3603 Composite Materials

56088 **(BDX—613-2983) Continuous plasma treatment and resin impregnation of a high-strength fiber material.** Tira, J.S. (Bendix Corp., Kansas City, MO (USA)). Sep 1983. Contract AC04-76DP00613. 28p. NTIS, PC A03/MF A01. Order Number DE84000314.

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A system was developed for the continuous plasma treatment of fibrous, reinforcing materials used in composites. Data are presented on the removal of moisture from Kevlar 49 Aramid by the use of argon and zero air plasma. Adhesion test results with plasma-treated, unidirectional Kevlar 49/epoxy laminates showed an improvement in adhesion ranging from 1.4 to 3.7 times, as reported by the plasma treatment effectiveness parameter. Limited tensile testing of resin-impregnated yarn showed no catastropic failure from plasma treatment.

56089 **(MLM—3106(OP)) Characterization of glass-filled engineering thermoplastic composites.** Whitaker, R.B.; Nease, A.B.; Yelton, R.O. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 7p. (CONF-830976—4). NTIS, PC A02/MF A01. Order Number DE84000361.

From 12. North American Thermal Analysis Society and 38. calorimetry conference; Williamsburg, VA, USA (25 Sep 1983).

Characterization of three engineering thermoplastic (TP) materials has been carried out to assess suitability for Mound applications: Poly(etheretherketone) (PEEK), Poly(etherimide) (PEI), and Poly(ethersulfone) (PES). Analyses included: thermogravimetric (TG), thermomechanical (TMA), direct probe/mass spectroscopy (DIP/MS), Fourier transform infrared spectroscopy (FT-IR), and other chemical analyses. Both neat and glass-filled PEEK and PES were studied; only unfilled PEI was examined. Thermogravimetric analysis of the three TP's in N_2 showed that all were $\geq$ 525°C in decomposition onset temperature, with PEEK > PEI > PES. Both glass-filled PEEK and PEI showed <1% weight loss in the melt after two hours (N_2). TMA analyses were used to determine expansion coefficients below T/sub g/ for all three TP's. The glass-filled PEEK exhibited a low temperature (~ 60 to 70°C) transition below T/sub g/ (~ 150°C) on the first TMA runs. This disappeared on subsequent TMA runs and did not reappear on aging/RT. DIP/MS analyses showed both water and phenyl sulfone to be present in PES and PEEK. Water only was observed in PEI. The presence of phenylsulfone in PEEK was confirmed by FT-IR, and sulfur was found to be present in amounts up to 0.23% in 30% glass-filled molding compounds. Residual polymerization solvent is a probable source. Fluoride (from a monomer in the PEEK polymerization) was also detected.

56090 **(UCID—19849) Statistical analysis of Kevlar 49/epoxy composite stress-rupture data.** Glaser, R.E. (Lawrence Livermore National Lab., CA (USA)). Sep 1983. Contract W-7405-ENG-48. 79p. NTIS, PC A05/MF A01. Order Number DE84000516.

Statistical analyses are presented for LLNL stress-rupture data sets involving kevlar 49/epoxy strands and NASA Kevlar 49/epoxy spherical pressure vessels subjected to sustained loading. Raw data, summarized inferences, and figures are included.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 55617

56091 **(BNL-NUREG—33641) Radiation resistance testing of high-density polyethylene.** Dougherty, D.R.; Adams, J.W. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 16p. (CONF-8308106—9). NTIS, PC A02/MF A01 - GPO. Order Number DE84000622.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

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Mechanical tests following gamma inrradiation and creep tests during irradiation have been conducted on high-density polyethylene (HDPE) to assess the adequacy of this material for use in high-integrity containers (HICs). These tests were motivated by experience in nuclear power plants in which polyethylene electrical insulation detoriorated more rapidly than expected due to radiation-induced oxidation. This suggested that HDPE HICs used for radwaste disposal might degrade more rapidly than would be expected in the absence of the radiation field. Two types of HDPE, a highly cross-linked rotationally molded material and a non-cross-linked blow molded material, were used in these tests. Gamma-ray irradiations were performed at several dose rates in environments of air, Barnwell and Hanford backfill soils, and ion-exchange resins. The results of tensile and bend testing on these materials following irradiation will be presented along with preliminary results on creep during irradiation.

56092 **Scaling in multichain polymer systems in two and three dimensions.** Bishop, M.; Kalos, M.H.; Sokal, A.D.; Frisch, H.L. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012). *Journal of Chemical Physics;* **79**: No. 7, 3496-3499(1 Oct 1983).

The mean dimensions of multichain polymer systems are predicted to follow a scaling relation with scaling variable X = l/sup d/ν-1 rho, where l is the number of statistical segments on the chain, rho is the segment density, d is the dimension, and ν is the critical exponent for the mean dimensions of an isolated polymer chain. The scaling laws are <R^2>roughly-equalA(X) l/sup 2nu/ for l→ ∞ with X bounded, and <R^2>roughly-equalB(rho) l for l→ ∞ with X → ∞. Moreover, the critical amplitudes behave as A(X)~X/sup()(-2nu-1/d/ν-1) as X → ∞ and B(rho)~rho/sup()(-2nu-1/d/ν-1) as rho → 0. Simulations of both continuum and lattice systems are reanalyzed and found to be consistent with these scaling relations. Previous naive use of short-chain data has led to misleading results.

56093 **Influence of attractions on the static and dynamic properties of simulated single and multichain systems.** Bishop, M.; Kalos, M.H.; Frisch, H.L. (Courant Institute of Mathematical Sciences, New York, New York 10012). *Journal of Chemical Physics;* **79**: No. 7, 3500-3504(1 Oct 1983).

The influence of the attractive portion of the Lennard-Jones potential on the statics and dynamics of both single chain and multichain systems is investigated by reptation and molecular dynamics simulations. There is no significant effect at a reduced temperature of 10.0. At a temperature of 1.7 the single chain and multichain system at low densities (0.1) indicate that the attractions cause both the chains to be significantly more compact and a slowing of the time autocorrelation functions of the square of the end-to-end distance and radius of gyration. At a moderate density of 0.5, the attractions have almost no effect on the static structure, but they still influence the dynamic properties.

56094 **Coulomb effects on one-dimensional Peierls instability: The Peierls-Hubbard model.** Mazumdar, S.; Dixit, S.N. (Center For Nonlinear Studies, Los Alamos National Laboratories, Los Alamos, New Mexico 87545). *Physical Review Letters;* **51**: No. 4, 292-295(25 Jul 1983).

A novel approach to dimerization is developed, based on a many-body valence-bond approach, that predicts enhancement of the dimerization on inclusion of the on-site electron repulsion. Exact numerical calculations are presented to substantiate this conclusion.

56095 **Stress chemiluminescence of polymeric materials; predictive applications to the aging process.** Monaco, S.B.; Richardson, J.H.; Breshears, J.D.; Lanning, S.M.; Bowman, J.E.; Walkup, C.M. (Lawrence Livermore National Lab., CA). *Industrial and Engineering Chemistry, Product Research and Development;* **21**: No. 4, 546-549(1982). Contract W-7405-ENG-48.

From 183. national meeting of the American Chemical Society; Las Vegas, NV, USA (28 Mar 1982).

A computer-controlled stress chemiluminescence instrument has been designed and assembled. The significant result of this

work is the correlation of an enhanced chemiluminescence signal in a low stress environment with the subsequent premature mechanical failure of samples of TGMDA-DDS, the most common epoxy system used as a matrix for high-performance composites. Preliminary results with cellular silicone elastomers indicate a correlation between chemiluminescence, a dynamic measurement of a microscopic process, and load deflection curves, a dynamic measurement of macroscopic properties of the elastomer. Arrhenius plots of stressed and unstressed samples yield different activation energies and show a break in the slope at a temperature above which accelerated aging tests become unrealistic. Currently, only epoxy and cellular silicone samples have been examined with any depth; not all epoxy samples give a stress chemiluminescence signal.

56096 **Permeability of plastic films and coatings to gases, vapors, and liquids.** Hopfenberg, H.B. (ed.). New York, NY; Plenum Press (1974). 481p. (CONF-740349—P8). Plenum Press, 227 West 17th Street, New York, NY 10011 $37.50.

From 167. national meeting of the American Chemical Society; Los Angeles, CA, USA (31 Mar 1974).

This volume deals with the solution, diffusion, and permeation of gases, vapors, and liquids in a wide variety of industrially important synthetic polymeric films. Offering accounts of the most recent theoretical problems and practical applications of these transport processes, leading specialists discuss current research areas including pressure-driven transport through homogeneous and microporous films and the analysis of the diffusion of gases in glassy packaging films. This book treats fundamental concepts and covers membrane and barrier film applications and membrane-moderated biomedical devices, including controlled drug delivery and artificial organ membranes.

3606 Other Materials

REFER ALSO TO CITATION(S) 55496, 55587, 55594, 56006, 56229

56097 **(CONF-820945—11) Ion-beam mixing in silicon and germanium at low temperatures.** Clark, G.J.; Marwick, A.D.; Poker, D.B. (International Business Machines Corp., Yorktown Heights, NY (USA). Thomas J. Watson Research Center; Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 26p. NTIS, PC A03/MF A01. Order Number DE84000212.

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

Ion-beam mixing of thin marker layers in amorphous silicon and germanium was studied using irradiations with Xe ions at temperatures of 34k and 77k. The marker species, ion energies and doses were: in silicon, markers of Ge and Pt irradiated with 200-keV Xe up to 2.7×10^{16} ions cm^{-2}; and in germanium, markers of Al and Si bombarded with 295-keV Xe up to 1.63×10^{16} ions cm^{-2}. In silicon, Pt markers were found to broaden at about the same rate at 34k and 77k; and the rate of broadening was similar to that found by other workers when expressed as an efficiency of mixing, i.e., when dependence on ion dose and deposited energy was factored out. However, a Ge marker irradiated at 34k did not broaden from its original thickness. In germanium, markers of both Al and Si were mixed by irradiation at 34k, but at 77k only the Al marker broadened; the Si marker did not. The broadening of the markers is ascribed to ballistic mixing, while the cases where no broadening occurred are explicable if diffusion by a defect mechanism transported displaced marker atoms back to traps near their original sites.

56098 **(CONF-831187—2) Orientation of Gd moments in RE/sub x/Gd/sub 1-x/Rh_4B_4 (RE = Ho, Er).** Noakes, D.R.; Umarji, A.M.; Shenoy, G.K.; Hinks, D.G. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84000609.

From MMM conference; Pittsburg, PA, USA (8 Nov 1983).

The orientation of the Gd magnetic moment with respect to the crystallographic axes in the magnetically ordered states of $GdRh_4B_4$ and RE/sub x/Gd/sub 1-x/Rh_4B_4 (RE = Ho and Er) materials has been studied with the ^{155}Gd Moessbauer effect. Rare earth single ion anisotropies induced by the crystalline electric field (CEF) force the Gd moment to point in particular directions. These directions depend on which rare earth has been substituted into the lattice and will be discussed in terms of a CEF model for these materials. The results demonstrate that the ^{155}Gd Moessbauer effect can be used as a probe of magnetic ordering directions in rare earth materials.

56099 **(CONF-8309156—4) Studies of neutron irradiation effects at IPNS-REF.** Kirk, M.A. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84000584.

From 7. meeting of the international collaboration on advanced neutron sources; Ontario, Canada (12 Sep 1983).

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Neutron irradiation effects studies at the Radiation Effects Facility (REF) at the Intense Pulsed Neutron Source (IPNS) located at Argonne National Laboratory (ANL) are reviewed. A brief history of the development of this user facility is followed by an overview of the scientific program. Experiments unique to a spallation neutron source are covered in more detail. Future direction of research at this facility is suggested.

56100 **(INIS-mf—8472) Tracer diffusion studies of ^{26}Mg, ^{30}Si and ^{18}O in single crystal forsterite (Mg_2SiO_4) and of ^{18}O in single crystal SiO_2.** Schachtner, R. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.)). 1981. 166p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703479.

Diss. (D.Eng.).

Tracer diffusion coefficients of Mg, Si and O in monocrystalline forsterite were determined by SIMS as a function of temperature and crystal orientation. Former results on oxygen diffusion in SiO_2 single crystals using nuclear activation methods were confirmed by SIMS data. The influence of crystal defects and impurities is discussed. (TW).

56101 **(Juel-Spez—167) Graphitic matrix materials for spherical HTR fuel elements.** Rind, W.; Schulze, R.E.; Schulze, H.A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1982. 136p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

This report is an extended English language version of the report Juel–1752.

The present report comprises the essential results of material development and irradiation testing of graphitic matrix materials for spherical HTR fuel elements and completes the documentation of the irradiation data for 20 matrix materials (Juel-1702). The main emphasis is given to the matrices A3-3 (standard matrix) and A3-27 (matrix with synthesized resin), both of which are being used as structural materials for the fuel elements of the AVR and THTR reactors. In addition, comparisons are made between 18 A3-variants and the standard matrix A3-3, which show that three of the variants may be considered as a further potential for use. Moreover, the possibilities for HTR fuel elements which are opened up by the introduction of a new technology, warm moulding, are also illustrated.

56102 **(NP—3770378) Influence of rate of combustion on the properties of carbon materials.** Rosenblatt, U.; Schmid*, P. (Schunk und Ebe G.m.b.H., Giessen (Germany, F.R.)). Jan 1982. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770378.

The influence of rate of combustion on the properties of carbon materials is described in this paper. Six different carbon mixtures with combustion rates from 12 to 600 K/h were studied. For dense materials a clear density and stability maximum is shown to exist at high combustion rates. The existance of this maximum can probably be explained by an alteration in coking mechanism which permits a higher macroscopic shrinkage.

56103 **(RFP—3541) Radiation effects on Dowex MSC-1, Amberlite 252, and Duolite C-264 ion exchange resins.** Kazanjian, A.R.; Stevens, J.R. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 12 Sep 1983. Contract AC04-76DP03533. 11p. NTIS, PC A02/MF A01. Order Number DE84000847.

The radiation effects on three new cation exchange resins were investigated. The resins were Dowex MSC-1, Amberlite 252, and Duolite C-264. The properties examined were ion exchange capacity, moisture content, plutonium loading and elution characteristics, thermal stability, and gas generation. There were some differences in the radiation effects on these properties but the overall radiation stability was considered to be about the same. The resins were relatively radiation stable, indicative of cation resins of this type.

56104 **(SAND—83-1303C) Origin of electron-bombardment enhanced reactivity of graphite with hydrogen.** Ashby, C.I.H. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 4p. (CONF-831171—2). NTIS, PC A02/MF A01. Order Number DE83017561.

From American Vacuum Society meeting; Boston, MA, USA (1 Nov 1983).

Electronic excitation of graphite by photon or electron bombardment leads to formation of an excited state species which is responsible for the enhancement of the methane formation reaction. The means of inducing the initial excitation is not important; the ultimate consequence will be enhanced erosion.

56105 **(UCRL—89713) Equation of state of helium and polybutene and Raman spectrum of water at high shock pressures and temperatures.** Nellis, W.J.; Holmes, N.C.; Mitchell, A.C.; Trainor, R.J.; Boslough, M.B.; Ree, F.H.; Walrafen, G.E. (Lawrence Livermore National Lab., CA (USA); Howard Univ., Washington, DC (USA)). Aug 1983. Contract W-7405-ENG-48. 4p. (CONF-830768—3). NTIS, PC A02/MF A01. Order Number DE84000157.

From 9. International Association for the Advancement of High Pressure Science and Technology conference; Albany, NY, USA (25 Jul 1983).

Hugoniot EOS measurements on liquid helium are in good agreement with theory of Young et al. The Raman spectrum of shocked water showed that the O-H stretch band was red-shifted about 15 cm^{-1} and narrowed about 20%. Hugoniot P-V and shock temperature data for polybutene are in good agreement with a Mie-Grueneisen model. (DLC)

56106 **Independently variable band gaps and lattice constants in GaAsP strained-layer superlattices.** Biefeld, R.M.; Gourley, P.L.; Fritz, I.J.; Osbourn, G.C. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **43**: No. 8, 759-761(15 Oct 1983). Contract AC04-76DP00789.

The capability of independently varying band gaps and lattice constants in ternary strained-layer superlattices has been experimentally demonstrated for the first time. High-quality GaAs/sub x/P_1/sub -//sub x//GaP superlattices ($0<x<$ or $=0.62$, lattice mismatches up to 2.3%) were grown by metalorganic chemical vapor deposition and their band gaps and lattice constants were measured. The band gaps at each composition agree with calculated values, and differ significantly from the band gaps of bulk alloys with the same lattice constant. This newly demonstrated capability could allow high-quality heterojunction devices to be grown in a variety of lattice-mismatched ternary systems.

56107 **(UCRL-Trans—11901) Measurement of the adiabatic equation of state.** Prut, V.V. (Lawrence Livermore National Lab., CA (USA); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 20 Sep 1983. Contract W-7405-ENG-48. Translation of Preprint IAE-3255 9/M, 1980. 33p. NTIS, PC A03/MF A01. Order Number DE84000035.

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Methods of measuring the adiabatic equation of state in the megabar pressure range are analyzed. It is shown that the published results are inconsistent. 17 references.

56108 **Field evaporation of silicon and field desorption of hydrogen from silicon surfaces.** Kellogg, G.L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 4, 1957-1964(15 Aug 1983).

The field evaporation of silicon in ultrahigh vacuum and in hydrogen has been studied with the use of the pulsed-laser atom probe. Measurements of the ion yields of various field-evaporated and field-desorbed species were made as a function of applied voltage, laser power, hydrogen background pressure, and laser pulse rate. The results indicate that, in ultrahigh vacuum and above cryogenic temperatures, field evaporation of silicon is qualitatively the same as for metals. In hydrogen, however, the field-evaporation process is quite different from that of metals, with the rate-limiting step being the field-enhanced formation of surface hydrides. Field-desorbed H^+ and H_3^+ ions are shown to arise from a field-adsorbed binding state, and the voltage range where H_3^+ dissociates to H^+ is used to calibrate the electric field strength. The low-temperature evaporation field of silicon is estimated from this calibration to be 3.3—3.6 V/A, which is considerably higher than the currently accepted value of 2.0 V/A. Field-desorbed H_3^+ ions are detected only when oxide contamination is present on the silicon surface. If we assume that the mechanism of H_3^+ formation is the same as that proposed for metals, this observation suggests that weakly bound, chemisorbed hydrogen atoms exist on silicon only in the presence of surface contamination.

56109 **Synchrotron-radiation studies of the transition of hydrogenated amorphous carbon to graphitic carbon.** Wesner, D.; Krummacher, S.; Carr, R.; Sham, T.K.; Strongin, M.; Eberhardt, W.; Weng, S.L.; Williams, G.; Howells, M.; Kampas, F. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 4, 2152-2156(15 Aug 1983).

Using the synchrotron-radiation facility at Brookhaven National Laboratory, we have studied the electronic structure of thin hydrogenated amorphous carbon films produced by dc glow discharges of hydrocarbons. Valence-band photoemission measurements on these films yielded information on the occupied valence-band density of states, while near-edge absorption at the carbon K edge elucidated features of the unoccupied conduction band. The as-deposited, unannealed films are essentially amorphous, showing no extended x-ray absorption fine-structure (EXAFS) features. Valence-band photoemission results show that these films are insulating, suggesting tetrahedral (diamondlike) coordination. The near-edge-absorption results, however, show some unsaturated carbon-carbon bonds as evidenced by a $1s \rightarrow \pi($ feature. Upon annealing, the films become more graphitic as evidenced by both the photoemission and near-edge-absorption measurements showing fine structure in agreement with that observed for crystalline or microcrystalline graphite. They also become conductive. Annealing is accompanied by evolution of hydrogen from the films, and this appears correlated with the development of certain features of the band structure as the film orders. The annealed films also show the beginnings of features in the EXAFS region.

56110 **Quantum oscillations in strained-layer superlattices.** Schirber, J.E.; Fritz, I.J.; Dawson, L.R.; Osbourn, G.C. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 4, 2229-2231(15 Aug 1983). Contract AC04-76DP00789.

Large-amplitude quantum oscillations are observed in the magnetotransport in GaAs-Ga/sub 0.8/In/sub 0.2/As strained-layer superlattices. These measurements demonstrate that single-crystal perfection and high mobilities at low temperatures can be achieved in a new class of semiconductor structures. The properties of these structures can be tailored easily over a wide range inaccessible to naturally occurring lattice-matched heterostructures.

56111 Direct surface structure determination with photoelectron diffraction. Barton, J.J.; Bahr, C.C.; Hussain, Z.; Robey, S.W.; Tobin, J.G.; Klebanoff, L.E.; Shirley, D.A. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 and Departments of Chemistry and Physics, University of California, Berkeley, California 94720). *Physical Review Letters;* **51**: No. 4, 272-275(25 Jul 1983). Contract AC03-76SF00098.

Angle-resolved photoemission extended fine structure from adsorbate core levels yields complete, accurate surface structures without resort to trial-and-error comparisons to theory. Scattering peaks from individual substrate atoms were observed with use of S(1s) photoemission from c(2 x 2)S/Ni(001) and p(2 x 2)S/Cu(001), along [011]. Fourfold-hollow site geometries were found for both systems, with interatomic distances of R(S-Ni) = 2.24(3) A and R(S-Cu) p = 2.28(3) A.

56112 Recent studies on radiation induced F-center and colloid particle formation in synthetic NaCl and natural rock salt. Levy, P.W.; Loman, J.M.; Swyler, K.J.; Dougherty, D.R. (Brookhaven National Lab., Upton, NY (USA)). *Radiation Effects;* **72**: No. 1-4, 303-308(Jun 1983). (CONF-820864—). Contract AC02-76CH00016.

From 4. europhysical topical conference on lattice defects in ionic crystals; Dublin, Ireland (30 Aug 1982).

Radiation induced F-center and Na metal colloid formation have been studied, at temperatures between 100 and 350 deg C, in melt growth synthetic NaCl crystals and natural rock salt samples, using equipment for making optical measurements during 1 to 3 MeV electron irradiation. In both types of NaCl the damage formation kinetics are qualitatively similar. However, there are large quantitative differences which depend on irradiation temperature, dose rate, total dose, inherent strain, strain applied prior to irradiation and other factors. Natural rock salt samples from different localities exhibit markedly different radiation induced colloid formation rates. An extrapolation of the current data to the doses expected in radioactive waste depositories indicate that natural salt immediately adjacent to the planned waste canisters could develop between 0.1 and 50 percent colloidal sodium in 50 to 400 years.

56113 An electrochemical study of the mixed beta-vanadium bronzes Li /SUB y/ Na /SUB x/ V_2O_5 and Li /SUB y/ K /SUB x/ V_2O_5. Raistrick, I.D.; Huggins, R.A. (Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305). *Materials Research Bulletin;* **18**: No. 3, 337-346(Mar 1983).

It has been found that lithium may be rapidly inserted into β-phase sodium and potassium vanadium bronzes to yield phases of composition Li /SUB y/ Na /SUB x/ V_2O_5 and Li /SUB y/ K / SUB x/ V_2O_5. For (x + y) values less than about 2/3, a single phase region is found. For higher lithium contents two additional narrow phases are formed; the maximum alkali metal content appears to correspond to a vanadium oxidation state of 4. The reversibility of the insertion reactions and x-ray powder diffraction indicate that the structures of the higher lithium content phases are closely related to the β-phase. Thermodynamic data have been derived from the electrochemical results.

56114 Transition metal ions in silicate melts. Part 2. Iron in sodium silicate glasses. Fox, K.E.; Furukawa, T.; White, W.B. (Pennsylvania State Univ., University Park). *Physics and Chemistry of Glasses;* **23**: No. 5, 169-178(Oct 1982). Contract AC02-76ER02754.

Optical absorption, luminescence, and Raman spectra were measured for sodium silicate glasses melted in air, containing about 85% Fe(III) and 15% Fe(II). Luminescence intensities for individual samples were compared. Three d-d bands in the optical absorption spectrum due to Fe(III) at about 26,000, 24,000, and 23,000 cm^{-1} were assigned to the $^4E(D)$, $^4T_2(D)$ and $^4A_1\,^4E(G)$ levels of the d^5 configuration. Another very weak band arose from the $^4T_2(G)$ level. Luminescence spectra indicated an unobserved band at around 16,200 cm^{-1} due to the $^4T_1(G)$ level. Raman and luminescence spectra both showed that two distinct fourfold coordinated environments for Fe(III) existed in the glasses. In glasses of low sodium content, Fe(III) substitutes for Si with four bridging oxygens, producing Raman bands at 980 cm^{-1} and luminescence at 14,600 cm^{-1}. In high sodium glasses, the Raman bonds occurred at 890 cm^{-1} and luminescence appeared at 16,200 cm^{-1}. It is argued that this may be a tetrahedral iron complex in the glass. Ferrous iron appeared to occupy a sixfold coordinated site the size of which decreased with increasing sodium concentration.

56115 Technique for growing massive single crystals of FeS. Cathcart, J.V.; Druschel, R.E.; Manley, L.C.; Petersen, G.F. (Oak Ridge National Lab., TN). *Journal of Crystal Growth;* **62**: 299-308(1982). Contract W-7405-ENG-26.

A modified Bridgman technique for growing massive Fe/sub 1-x/S crystals of known composition is described. Impurity content of the crystals is minimized through the use of BN crucibles and of procedures that avoid air contamination of the specially purified starting materials. Levels of metallic impurities range between 100 and 300 ppM while oxygen concentrations as low as 50 ppM (by weight) have been achieved. Means of minimizing stress generation and the subsequent cracking of the crystals during cooling are discussed. Rocking curve determinations indicate a mosaic spread of $\sim 0.1^\circ$ for the crystals, and the results of an accurate determination of the pressure dependence of the composition of the crystals are reported.

56116 Doping and compensation from ion implantation in InP and InAsP. Davies, D.E. Cardiff, England; University Coll. of South Wales and Monmouthshire (1980). 157p. British Library, Boston Spa, Wetherby, West Yorks. No. D36773/81.

Thesis.

The overall objective was to develop the potential of ion implantation for doping and creating semi-insulating regions in InP and InAssub(x)Psub(1-x). The technological importance of InP and its alloys is described and ion stopping mechanisms, together with the accompanying lattice damage and the need for annealing, are briefly discussed as a background to the implantation work. The status of implantation in GaAs, the only compound widely implanted, is reviewed and the approach adopted for this project is explained. Factors unique and critical to implantation in compounds together with the experimental procedures necessary are discussed at length. Conductivity changes resulting from ion irradiation damage rather than substitutional doping were investigated and a damage induced conduction rather than compensation was found on bombarding InAssub(0.75)Psub(0.25). The nature of the electrical effect changed with alloy composition until the more customary compensation was obtained in InAssub(0.2)Psub(0.8) and InP. Annealing studies on the implanted and damaged material were also carried out.

56117 Low energy ion implantation of silicon. Whitlow, H.J. Brighton, England; Sussex Univeristy (1980). 238p. British Library, Boston Spa, Wetherby, West Yorks. No. D36589/81.

Thesis.

The depth distribution of low-energy As (9-25 keV) and In (8-21 keV) ions implanted into silicon has been measured with the aim of finding out how well theoretical estimates fit the experimental data. The implants were 'technological' implants in that they were carried out into single crystal (100) surface silicon in an off-axis direction.

40 CHEMISTRY

56118 Thermodynamic constraints in reactor design. Shinnar, R. (City Univ. of New York, NY). *Annals of the New York Academy of Sciences;* **404**: 432-452(1983). (DOE/ER/12020—1; CONF-8206187—). Contract AC21-79ET14811.

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

The main emphasis of physicochemical hydrodynamics has been the study of the interaction between transfer processes and chemical kinetics. This interaction is also the main concern of chemical reaction engineering. Another area is described that is very useful in reaction engineering and the development of catalysts; namely, the way in which thermodynamic constraints direct

the development of catalysts and the design of chemical reactors. This is especially important today, since thermal efficiency has become much more important in the process industries, due to the recent changes in the cost of natural gas and oil. The constraints that determine thermal efficiency in a chemical process are examined. It will be shown that the constraints that limit efficiency are not inherent thermodynamic constraints but are, rather, the results of the limitations of available catalysts and available technology. A framework in which to evaluate these limitations and the chances of improving them will be presented.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 55405, 55406, 55408, 55486, 55551, 55912, 56065, 56156, 56173, 56264, 56265, 56266, 56338, 56532, 56657

56119 (ARL/TR—050, pp 140) **Radium (^{226}Ra) in environmental samples.** Cooper, M.B.; Wilks, M.J. Jan 1983. NTIS (US Sales Only), PC A08/MF A01.

In Annual review of research projects 1981.

56120 **(INIS-mf—8479) Nondestructive gamma activation analysis of mineral materials.** Randa, Z.; Spacek, B.; Kuncir, J.; Benada, J. (Ustav Nerostnych Surovin, Kutna Hora (Czechoslovakia)); Randa, Z. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1981. vpp. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703484.

The basic problems are described related to the use of gamma activation analysis. The applicability was studied of instrumental gamma activation analysis (IGAA) in geology. A number of minerals, rocks, marine sediments and reference materials were studied. For irradiation a betatron and a microtron were used. The results show that IGAA allows the simultaneous determination of a number of trace elements at concentrations of tenths of ppm. The results are given of comparisons made of the analytical possibilities of microtron IGAA and reactor INAA in geology. Tables show the results of the application of IGAA, the main products and parameters of photoexcitation reactions and graphically represented are the gamma spectra of measured materials. (J.B.).

56121 (INIS-mf—8479, pp vp) **I.2 Principle and comparison of analytical possibilities of GAA with other analytical methods.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

A comparison is made of gamma activation analysis and neutron activation analysis with regard to sensitivity, taking into account the cross sections of the photonuclear reaction (\,n) and the neutron capture (n,\). (H.S.).

56122 (INIS-mf—8479, pp vp) **I.5 Brief list of studies concerned with GAA.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

56123 (INIS-mf—8479, pp vp) **II.1 IGAA methodology.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

The individual working operations of IGAA are described including preactivation preparation, calibration standards and monitors used, irradiation, processing following activation, measurement of gamma spectra and processing of measured data. (J.P.).

56124 **(Juel-Spez—75) Comparison of different methods for activation analysis of geological and pedological samples: Reactor and epithermal neutron activation, relative and monostandard method.** Alian, A.; Sansoni, B. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung fuer Chemische Analyse). Apr 1980. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83750998.

Using purely instrumental methods, a comparative study is presented on neutron activation analysis of rock and soil samples by whole reactor neutron spectrum and epithermal neutrons with both relative and monostandard procedures. The latter procedure used with epithermal neutron activation analysis of soil samples necessitated the use of the 'effective resonance integrals' which were determined experimentally. The incorporation of the β factor, representing deviation of reactor epithermal neutron flux from 1/E law, is developed in the present work. The main criteria for the choice of one or more of the procedures studied for a given purpose are also indicated. Analysis of 15 trace elements, Ca and Fe in the standard Japanese granite JG-1 using monostandard epithermal neutron activation gave results in good agreement with the average literature values.

56125 **(LBL—16119) Heteronuclear dipolar couplings, total spin coherence, and bilinear rotations in NMR spectroscopy.** Garbow, J.R. (Lawrence Berkeley Lab., CA (USA)). Jul 1983. Contract AC03-76SF00098. 276p. NTIS, PC A13/MF A01. Order Number DE84001214.

Thesis.

In Chapter 1 a variety of different introductory topics are presented. The potential complexity of the nuclear magnetic resonsnace (NMR) spectra of molecules dissolved in liquid crystal solvents serves to motivate the development of multiple quantum (MQ) spectroscopy. The basics of MQ NMR are reviewed in Chapter 2. An experimental search procedure for the optimization of MQ pulse sequences is introduced. Chapter 3 discusses the application of MQ NMR techniques to the measurement of dipolar couplings in heteronuclear spin systems. The advantages of MQ methods in such systems are developed and experimental results for partially oriented [1-^{13}C] benzene are presented. Several pulse sequences are introduced which employ a two-step excitation of heteronuclear MQ coherence. A new multiple pulse method, involving the simultaneous irradiation of both rare and abundant spin species, is described. The problem of the broadening of MQ transitions due to magnetic field inhomogeneity is considered in Chapter 4. The method of total spin coherence transfer echo spectroscopy (TSCTES) is presented, with experimets on partially oriented acetaldehyde serving to demonstrate this new technique. TSCTES results in MQ spectra which are sensitive to all chemical shifts and spin-spin couplings and which are free of inhomogeneous broadening. In Chapter 5 the spectroscopy of spin systems of several protons and a ^{13}C nucleus in the isotropic phase is discussed. The usefulness of the heteronuclear bilinear rotation as a calculational tool is illustrated. Compensated bilinear π rotations, which are relatively insensitive to timing parameter missets, are presented. A new technique for homonuclear proton decoupling, Bilinear Rotation Decoupling, is described and its success in weakly coupled systems is demonstrated.

56126 **(MINTEK-M—95) Modern applications of polarography and voltammetry to inorganic analysis.** Lee, A.F. (Council for Mineral Technology, Randburg (South Africa)). 20 Jul 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84900094.

This report summarizes developments in polarography and voltammetry up to 1982. Modern electronic equipment and scanning waveforms are explained briefly. Extensive tables of recent inorganic applications, mainly in the geochemical and metallurgical fields, are included, and show results based on the new approaches. 266 references, 10 figures, 8 tables.

56127 **(NP—3770374) Comparing investigations on hand filters and vacuum disk filters on an industrial scale for determination of filtration resistance and filtration performance.** Merker, K.J. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 16 Jul 1982. 167p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770374.

Portions are illegible in microfiche products; Thesis.

Filtration resistances of aluminium hydroxide and brand-new felt fabrics which are determined by methods according to literature and own experiments are compared with results of volume-time measurements of hand and disk filters. The resistance values differ considerably. Merely volume-time measurements lead to real-

istic results showing that aluminium hydrate forms an incompressible filter cake within the range of 0,3 until 0,5 bar. The influence of working period and vacuum on filtration resistances was determined using disk filters. Filtrate throughput decreases to maximum 40%. Mathematical models of deposition of solid matter particles in filter cloth show that the cloth choking depends on a quality index of the compound system. The constructor of disk filters on an industrial scale should rest on laboraty filter experiments because hand filter results differ about 35% from those of disk filters.

56128 **(SAND—83-0944C) Improved spectrophotometric analysis of barium styphnate.** Brown, N.E.; Blasi, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-8310159—3). NTIS, PC A02/MF A01. Order Number DE84000449.

From Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics; Lake Ozard, MO, USA (31 Oct 1983).

A spectrophotometric procedure to determine the purity of barium styphnate monohydrate based upon the absorbance of the styphnate ion at 326 and 413.3 nm has been developed. The purity is determined by comparing the absorbance of the styphnate ion in barium styphnate and in styphnic acid. Our investigation has shown that the molar absorptivity and λ maxima of the styphnate ion are quite pH dependent; therefore, the pH is buffered to 6.8 to 7.0 with ammonium acetate. Under these conditions the molar absorptivity is 1.6×10^4 L/mol-cm. Analyses following the procedure in the Navy specification WS13444A using water were found to give low molar absorptivities (1.3×10^4 L/mol-cm) for the styphnic acid calibration resulting in erroneous values for barium styphnate purity.

56129 **High-resolution scanning transmission electron microscopy.** Crewe, A.V. (Univ. of Chicago, IL). *Science (Washington, D.C.);* **221**: No. 4608, 325-330(22 Jul 1983).

The article provides a general overview of the instrumentation, a discussion of its probe-forming system and its detection system. 8 figures.

56130 **Inductively coupled plasma-atomic emission spectroscopy: the determination of trace impurities in uranium hexafluoride.** Floyd, M.A.; Morrow, R.W.; Farrar, R.B. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). *Spectrochimica Acta, Part B: Atomic Spectroscopy;* **38**: 303-308(1983). (CONF-820181—). Contract W-7405-ENG-26.

From Plasma spectrochemistry conference; Orlando, FL, USA (4 Jan 1982).

An analytical method has been developed for the determination of trace impurities in high-purity uranium hexafluoride using liquid-liquid extraction of the uranium from the trace impurities followed by analysis with inductively coupled plasma-atomic emission spectroscopy. Detection limits, accuracy, and precision data are presented.

56131 **Detection of beryllium by laser-induced-breakdown spectroscopy.** Radziemski, L.J.; Cremers, D.A.; Loree, T.R. (Los Alamos National Lab., NM (USA)). *Spectrochimica Acta, Part B: Atomic Spectroscopy;* **38**: 349-355(1983). (CONF-820181—).

From Plasma spectrochemistry conference; Orlando, FL, USA (4 Jan 1982).

Using the new technique of laser-induced-breakdown spectroscopy a limit of detection was measured for beryllium in air of 0.5 ng/g (w/w), which is one-third of the OSHA limit for the 8-h average exposure to beryllium. Approximately linear working curves were obtained over the concentration range 0.5 to 2×10^4 ng g^{-1}. The potential application of this technique to a beryllium monitoring instrument is discussed.

56132 **Radiochemical determination of technetium-99.** Kaye, J.H.; Merrill, J.A.; Kinnison, R.R.; Rapids, M.S.; Ballou, N.E. (Pacific Northwest Lab., Richland, WA). *Analytical Chemistry;* **54**: 1158-1163(1982). Contract AC06-76RL01830.

A radiochemical method has been developed for determination of ^{99}Tc by which both the chemical yield and the yield-corrected amount of ^{99}Tc in a sample may be determined. The chemical yield estimation is based upon counting of low-energy internal-conversion electrons from the added isotopic tracer /sup 97m/Tc. Uncertainties in the ^{99}Tc and yield estimates depend on the amount of /sup 97m/Tc tracer used, the amount of ^{99}Tc in the sample, the fraction of time spent in counting with an added absorber, and the total counting period. For a 2000 min total counting period with 50% of it spent in counting with added absorber, with 20 counts min^{-1} of /sup 97m/Tc tracer added originally to the sample, and with 50% chemical yield the chemical yield uncertainty (relative standard deviation) is 2.3% and the detection limit is approximately 44 mBq of ^{99}Tc. 7 references, 6 figures, 2 tables.

56133 **Potentiometric microdetermination of catechol in the presence of its isomers using a lead-ion selective electrode.** Selig, W. (Lawrence Livermore National Lab., CA). *Mikrochimica Acta;* **2**: 141-147(1982). Contract W-7405-ENG-48.

Catechol was determined on the microscale by potentiometric titration with lead nitrate. Solutions were buffered to pH 9.5 with borate buffer. Emf's were monitored with a lead ion-selective electrode and a single junction reference electrode. Up to an eightfold excess of hydroquinone or resorcinol can be tolerated. 2 figures, 3 tables.

56134 **Interlaboratory evaluations of nickel and cadmium analyses in body fluids.** Sunderman, F.W. Jr. (Univ. of Connecticut, Farmington); Brown, S.S.; Stoeppler, M.; Tonks, D.B. pp 25-35 of IUPAC collaborative interlaboratory studies in chemical analysis. Egan, H.; West, T.S. (eds.). New York, NY; Pergamon Press (1982).

From IUPAC international symposium on the harmonization of collaborative analytical studies; Helsinki, Finland (20 Aug 1981).

International programs to assess, improve, and harmonize analyses of nickel and cadmium in body fluids have been organized by the Nickel and Cadmium Subcommittees of the IUPAC Commission on Toxicoloty. These programs include (a) cooperative interlaboratory surveys of analytical proficiency, (b) development of reference methods for nickel and cadmium analyses in body fluids, (c) collaborative interlaboratory trials of the reference methods, and (d) cooperative assessment of reference matrix materials for transfer and control of accuracy. Data from international surveys of nickel and cadmium analyses are presented to illustrate the progress that has been achieved and the work that is underway. This report contains suggested guidelines for collaborative interlaboratory trials and perspectives on definitions of certain fundamental terms. 43 references, 5 figures, 3 tables.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 55536, 56160, 56166, 56173

56135 (ARL/TR—050, pp 73-76) **Chemistry and structure of technetium complexes.** Baldas, J.; Boas, J.F.; Bonnyman, J.; Williams, G.A. Jan 1983. NTIS (US Sales Only), PC A08/MF A01.

In Annual review of research projects 1981.

The structures of tris(2-aminobenzenethiolato) technetium(VI) and dichlorobis(diethyldithiocarbamato) thionitrosyltechnetium(V) have been determined by single crystal x-ray diffraction analysis. The preparation and chemistry of thiocyanato complexes of technetium have been investigated.

56136 **(CONF-830763—14) Elastic moduli of H_2O: liquid, ice VI and ice VII.** Grimsditch, M.; Rahman, A.; Polian, A. (Argonne National Lab., IL (USA); Paris-6 Univ., 75 (France). Lab. de Physique des Milieux tres Condenses). 1983. Contract W-31-109-ENG-38. 8p. NTIS MF A01. Order Number DE83017960.

From 9. AIRAPT conference; Albany, NY, USA (25 Jul 1983).

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The results of a Brillouin scattering study of the room temperature phases of H_2O (liquid, ice VI and ice VII) up to 30 GPa are presented. Longitudinal elastic moduli thus obtained are com-

pared with values of the bulk modulus obtained from density measurements and with both static and molecular dynamics calculations of the bulk modulus using potentials which have been proposed in studies of the liquid state. The calculations indicate that the potentials are not capable of describing the high pressure region of ice VII.

56137 **(CONF-830808—11) X-ray-diffraction studies of the structures of organic-phase solvent-extraction complexes.** Burns, J.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84000201.

From International solvent extraction conference; Denver, CO, USA (26 Aug 1983).

Structures were determined of the complexes which form when the uranyl ion is extracted from nitric acid solutions with organophosphorus reagents: $UO_3(TBPO)_3(NO_3)_2$, $UO_3(TiBP)_2(NO_3)_2$, $UO_2(DBP)_2$, and $UO_2(DBP)(TBPO)NO_3$. (TiBP = tri-isobutyl phosphate.) (DLC)

56138 **(CONF-830859—9) Identification and estimation of model parameters in electrochemical-reactor design.** Lee, J. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84000567.

From National meeting of the American Institute of Chemical Engineers; Denver, CO, USA (28 Aug 1983).

Mathematical modeling has become a powerful tool for the design, scale-up, and optimization of electrochemical reactors. However, comprehensive models for large-scale reactors often involve a large number of input parameters, many of which are not known a priori. This paper briefly describes how these parameters are estimated from experimental observations, and what computational techniques can be used for such analyses. Possible applications of these methods in electrochemical reactor engineering are also reviewed.

56130 **(NP—3770375) Measurement of caloric and respiratoric values in oxidation processes for determination of environmental chemicals.** Schauerte, W.A. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 16 Jul 1981. 165p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770375.

Portions are illegible in microfiche products; Thesis.

The thesis starts with a chapter on methods for detection of environment chemicals. Then methods of calorimetry are described and calorimetric and quasiadiabatic methods are discussed. In the chapter on the quasiadiabatic biocalorimeter in particular the calorimeter cell, measurement and regulation of temperature, the simplified calorimeter system and the measuring cell are treated. The following chapter on electrochemical oxygen measurement includes measurement principle and practical performance. In the next chapter on measurement of oxidation processes by means of the developed biocalorimeter the measurement course and evaluation and the test results are enumerated.

56140 **(PB—83-201301) Equations for a 3 dimensional transient flow of a multicomponent gas mixutre with chemical reactions. Publication No. 2.** Vos, J.B. (Technische Hogeschool Delft (Netherlands). Dept. of Aerospace Engineering). Nov 1982. 30p. (LR—362). NTIS, PC E04/MF E01.

This report gives a general description of the basic equations for the 3-dimensional transient flow of a multicomponent gas mixture with chemical reactions. The number of assumption made is small. Next to the equation of momentum, the equation of angular momentum is introduced. It could in the future be advantageous to use the latter equation instead of the first because the flow may possess vortices which introduce an angular momentum. In the first chapter of this report, the conservation equations are introduced. In the next chapters, the processes which occur on microscale are described. In the last chapter, the conservation equations are modelled for turbulence. This is done with Reynolds' decomposition and time-averaging of the subsequent equations.

56141 **Lone-pair and core ionization potentials of planar ammonia and phosphine. The use of core and valence ionization potentials to quantify the bonding and antibonding character of molecular orbitals of compounds of nitrogen and phosphorus.** Eyermann, C.J.; Jolly, W.L. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **87**: No. 16, 3080-3082(4 Aug 1983). Contract AC03-76SF00098.

For both ammonia and phosphine, the differences between the ionization potentials of the pyramidal and planar forms were calculated by an ab initio self-consistent field SCF method. The lone-pair ionization potential differences, IP(planar)-IP(pyramidal), are -1.0 and -2.3 eV for NH_3 and PH_3, respectively.The core binding energy shifts, E/sub B/(planar)-E/sub B/(pyramidal), are -0.3 and -0.4 eV for PH_3, respectively. By combining these data with appropriate experimental valence and core ionization potentials, it is possible to quantify the bonding or antibonding character of molecular orbitals of nitrogen and phosphorus compounds. The method is illustrated by using data for several nitrogen- and phosphorus-containing species. 4 tables.

56142 **Current status of transition-state theory.** Truhlar, D.G. (Univ. of Minnesota, MN); Hase, W.L.; Hynes, J.T. *Journal of Physical Chemistry;* **87**: No. 15, 2664-2682(21 Jul 1983). Contract AC02-79ER10425.

We review the current status of transition-state theory. We focus on the validity of its basic assumptions and of corrections to and improvements of conventional transition-state theory. The review is divided into sections concerned in turn with biomolecular reactions in the gas phase, unimolecular reactions in the gas phase, and isomerizations and atom-transfer reactions in liquid-phase solutions. Some aspects that are emphasized are variational transition-state theory, tunneling, the assumption of an equilibrium distribution of reactants, and the frictional effects of solvent molecules.

56143 **Methods for plotting trajectories for triatomic molecules and visualizing the caustics.** Noid, D.W. (Oak Ridge National Lab., TN); Wardlaw, D.M.; Koszykowski, M.L.; Marcus, R.A. *Journal of Physical Chemistry;* **87**: No. 15, 2733-2738(21 Jul 1983). Contract W-7405-ENG-26.

A simple and efficient computational method is introduced for visualizing the structure of three-dimensional classical trajectories. Examples are presented for Hamiltonians with incommensurate frequencies, as well as with 1:1 and 2:1 resonances. Results are also presented for several states of OCS, one of which shows an accidental 4:1 resonance. Implications of this method for path integral quantization and perturbation methods are discussed. 8 figures.

56144 **Structure of classical trajectories in multidimensional bound molecular systems.** Ashton, C.J.; Muckerman, J.T. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **87**: No. 15, 2738-2744(21 Jul 1983).

A computational method is described which enables visualization of the coordinate space envelopes of classical trajectories in multidimensional bound molecular systems. The method is exemplified by application to a realistic three-dimensional model of the vibrating water molecule, and its utility in the application of semiclassical quantization techniques is emphasized. 8 figures.

56145 **Computer modeling of rare solvent exchange.** Connick, R.E. (Univ. of California, Berkeley); Alder, B.J. *Journal of Physical Chemistry;* **87**: No. 15, 2764-2771(21 Jul 1983). Contract W-7405-ENG-48;AC03-76SF00098.

Computer calculations in which the system is equilibrated in constrained states along the reaction trajectory agree with unconstrained simulations at a relatively low activation energy, but are orders of magnitude more efficient. For a more realistic activation energy, the two-dimensional computer model shows that at the top of the barrier the two exchanging particles are at an intermediate distance between the first and second coordination shell, separated in angle by the solvent molecules in the first coordination shell, in order to allow more efficient local packing. Exchange occurs by a highly collective motion involving very many small displacements of all the particles in the first two coordination shells. The crossing of the barrier is more akin to diffusion rather than the unidirectional motion of a particle with an effective mass in a constant po-

tential field, as envisioned in the transition-state model. 10 figures, 2 tables.

56146 Solubility of H_2-He mixtures in fluid phases to 1 GPa. Ree, F.H. (Lawrence Livermore National Lab., CA). *Journal of Physical Chemistry;* **87**: No. 15, 2846-2852(21 Jul 1983). Contract W-7405-ENG-48.

Statistical mechanical variational theory and an improved van der Waals one-fluid model have been used to compute the solubility lines of hydrogen-helium mixtures in fluid phases at several temperatures. Quantum corrections to $O(h^2)$ are included. This is done by developing a new formula for the effective one-component mass for the mixtures. Monte Carlo simulations were performed to show the reliability of the new theoretical model. The solubility lines of the H_2-He mixtures predicted with the new theory give satisfactory agreement with the experimental data of Streett at $T \geq 61.5$ K and to 1 GPa in pressure. At lower temperatures higher order quantum corrections to thermodynamic data become increasingly important. 4 figures, 3 tables.

56147 Incoherent inelastic neutron scattering, infrared, Raman, and x-ray diffraction studies of pentacarbonylmethylmanganese, $Mn(CO)_5CH_3$. Andrews, M.A. (Brookhaven National Lab., Upton, NY); Eckert, J.; Goldstone, J.A.; Passell, L.; Swanson, B. *Journal of the American Chemical Society;* **105**: No. 8, 2262-2269(20 Apr 1983).

Vibrational spectra for the prototype transition-metal alkyl complex pentacarbonylmethylmanganese have been obtained by incoherent inelastic neutron scattering (0 to 3200 cm^{-1}, 0 to 400 MeV) and by infrared (400 to 4800 cm^{-1}) and Raman (0 to 4000 cm^{-1}) spectroscopy. This study provides a comprehensive comparison of these complementary techniques. The resulting data have been used to assign all but a few of the fundamental vibrational modes in the complex. Significant findings in this regard are anomalously low methyl C-H stretching frequencies (2983 and 2910 cm^{-1}), a significantly revised assignment for the manganese-methyl stretch (416 cm^{-1}), and a tentative assignment for the methyl torsion frequency (174 cm^{-1}). A preliminary single-crystal x-ray diffraction study of the complex was also undertaken (Pcmn, a = 6.366(2) A, b = 11.151 (3) A, c = 11.955 (3) A, Z = 4), but a near statistical disorder of the methyl group over all six of the octahedral coordination sites about the manganese precluded derivation of any significant bonding parameters. Prospects for the application of IINS to molecular spectroscopy and to the study of heterogeneous catalytic processes are discussed.

56148 Reduction of fluoropentaamminecobalt(III) by 1-ethoxyethyl and 2-hydroxy-2-propyl radicals: a kinetic competition study. McHatton, R.C.; Espenson, J.H. (Iowa State Univ., Ames). *Inorganic Chemistry;* **22**: No. 5, 784-786(2 Mar 1983). Contract W-7405-ENG-82.

Kinetic competition experiments on the indicated reactions were conducted at 25°C and μ = 1.00 M. The rate constants are as follows: $.C(CH_3)_2OH$, 2.2 x 10^6 M^{-1} s^{-1}; $.CH(CH_3)OC_2H_5$, 1.1 x 10^6 M^{-1} s^{-1}. The independently known rate constants for the competing reagents $(Co(en)_3)^{3+}$ and $Co(NH_3)_5Cl^{2+}$, respectively) were used in the evaluation of the results.

56149 Effect of joule heating in electrochemical measurement of hydrogen transport. Lin, R.W.; Johnson, H.H. (Department of Materials Science and Engineering, Cornell University, Ithaca, New York 14853). *Scripta Metallurgica;* **16**: No. 9, 1091-1093(Sep 1982).

It is shown that Joule heating during electrochemical charging at high current densities can produce substantial heating of the specimen and results in an increase in measured anodic current. Localized electrolyte heating and specimen temperature rise is a function of cell geometry and electrolyte circulation. The anodic current increase due to heating depends on the anodic current before charging and the palladium coating used. The steady state corrosion current depends on the strain rate and the method of deposition of the palladium coating on the anodic side. Finally, the present work demonstrates clearly that the increase in anodic current observed immediately after electrochemical charging during plastic deformation in nickel is due to Joule heating of the specimen and not dislocation transport of hydrogen.

56150 Effect of structural environment on the absorption spectra of selected lanthanide sesquioxides. Haire, R.G.; Young, J.P.; Peterson, J.R. (Oak Ridge National Lab., TN). pp 171-176 of Rare earths in modern science and technology. Volume 3. McCarthy; Silber; Rhyne (eds.). New York, NY; Plenum Publishing Corporation (1982). Contract W-7405-ENG-26.

Solid-state absorption spectra and x-ray powder diffraction have been used to study the transplutonium elements in several oxidation states. During the course of these studies it was found that a compound's structure, or its local environment, can be deduced from its solid-state spectrum, once the spectrum has been correlated with a particular structure. The object of the present study was to ascertain if room-temperature absorption spectral data could be used to determine the structural environment of a lanthanide sesquioxide. To evaluate this technique several experiments were carried out using pure lanthanide oxides or lanthanide oxide mixtures. Described here are the absorption spectra obtained from neodymium, samarium, dysprosium and erbium sesquioxides in matrices which exhibit three different crystal forms. 8 references, 14 figures.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 55445, 55448, 56135, 56141, 56142, 56145, 56173, 56176, 56178, 56178, 56299, 56378

56151 (DOE/ER/04694—T2) Proton transfer and unimolecular decay in the low-energy-reaction dynamics of H_3O^+ with acetone. Creasy, W.R.; Farrar, J.M. (Rochester Univ., NY (USA). Dept. of Chemistry). 1983. Contract AC02-78ER04694. 32p. NTIS, PC A03/MF A01. Order Number DE84000471.

The title reaction has been studied at collision energies of 0.83 and 2.41 eV. Direct reaction dynamics have been observed at both energies and an increasingly high fraction of the total energy appears in product translation as the collision energy increases. This result is consistent with the concept of induced repulsive energy release, which becomes more effective as trajectories sample the corner of the potential energy surface. At the higher collision energy, the protonated acetone cation undergoes two unimolecular decay channels: C-C bond cleavage to CH_3CO^+ and CH_4, and C-O bond cleavagto $C_3H_5^+$ (presumably to allyl cation) and H_2O. The CH_3CO^+ channel, endothermic relative to ground state protonated acetone cations by 0.74 eV, appears to liberate 0.4 eV in relative product translation while the $C_3H_5^+$ channel, endothermic by 2.17 eV, liberates only 0.07 eV in relative translation. These results are discussed in terms of the location on the reaction coordinate and magnitudes of potential energy barriers to 1,3-hydrogen atoms shifts which must precede the bond cleavage processes.

56152 (LA-UR—83-2689) Surface science study of selective ethylene epoxidation catalyzed by the Ag(110) surface: structural sensitivity. Campbell, C.T. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 17p. (CONF-831171—5). NTIS, PC A02/MF A01. Order Number DE84001324.

From American Vacuum Society meeting; Boston, MA, USA (1 Nov 1983).

The selective oxidation of ethylene to ethylene epoxide ($C_2H_4 + 1/2\ O_2 \rightarrow C_2H_4O$) over Ag is the simplest example of kinetically-controlled, selective heterogeneous catalysis. We have studied the steady-state kinetics and selectivity of this reaction for the first time on a clean, well-characterized Ag(110) surface by using a special apparatus which allows rapid (~ 20 s) transfer between a high-pressure catalytic microreactor and an ultrahigh vacuum surface analysis (AES, XPS, LEED, TDS) chamber. The effects of temperature and reactant pressures upon the rate and selectivity are virtually identical on Ag(110) and supported, high-surface-area Ag catalysts. The absolute specific rate (per Ag surface atom) is however some 100-fold higher for Ag(110) than for high-surface-area catalysts. This is related to the well-known structural sensitivity of this reaction. It is postulated that a small percentage of (110) planes (or [110]-like sites) are responsible for most of the catalytic activity of high-surface-area catalysts. The high activity of the (110) plane is attributed to its high sticking probability for dissociative oxygen ad-

sorption, since the rate of ethylene epoxidation is shown in a related work to be proportional to the coverage of atomically adsorbed oxygen at constant temperature and ethylene pressure.

56153 **(LA-UR—83-2838) Role of chlorine promoters in ethylene epoxidation over the Ag(110) surface.** Campbell, C.T.; Paffett, M.T. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 26p. (CONF-831174—2). NTIS, PC A03/MF A01. Order Number DE84001036.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The role of chlorine promoters in Ag catalysts for ethylene epoxidation can be accurately modeled with atomically adsorbed chlorine on Ag(110). Chlorine inhibits both EtO and CO_2 production, but CO_2 production more strongly, so that an overall promotion in selectivity (up to 85%) results. The major influence develops between the p(2 x 1)-Cl structure at Θ/sub Cl/ = 0.5 and the c(4 x 2)-Cl structure at Θ/sub Cl/ = 0.75. This suggests an ensemble effect. The variation of the steady-state rates, selectivity, and particularly coverage of O/sub a/ with Θ/sub Cl/ indicate that Cl/sub a/ replaces O/sub a/ in the reaction mechanism by creating Ag/sup δ+/ sites for enhanced ethylene adsorption. Adsorbed molecular O_2 seems to be the major oxidizing agent in epoxidation.

56154 **(UCRL—80940) Systematics of high-pressure and high-temperature behavior of hydrocarbons.** Ree, F.H. (Lawrence Livermore National Lab., CA (USA)). Mar 1978. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01. Order Number DE84000632.

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The Hugoniot data of eight different hydrocarbon compounds comprising four different proportions of hydrogen to carbon content have been analyzed using a model. The model assumes that hydrocarbons at high pressure (≧ 10 GPa) and high temperature (≧ 1000 K) dissociate into carbon in the diamond phase and hydrogen in a condensed molecular phase. The theoretical Hugoniots of hydrocarbons are evaluated under the assumption that the volume and its ratio to the Grueneisen gamma of the hydrocarbons at any given presure and 0 K are the weighted sums of the hydrogen and carbon contents. The model gives hydrocarbon Hugoniots that agree remarkably well with the experimental data. Evidence supporting the model and several implications of the model are given.

56155 **Unusual coordination and metal-ligand geometry of a vanadyl porphyrin in aqueous solution.** Shelnutt, J.A.; Dobry, M.M. (Sandia National Labs., Albuquerque, NM). *Journal of Physical Chemistry;* **87**: No. 16, 3012-3015(4 Aug 1983). Contract AC04-76DP00789.

Vanadyl uroporphyrin I in aqueous alkaline solution has considerably modified absorption and resonance Raman spectra when compared with vanadyl porphyrins in organic solvents or in the crystalline state. Under these latter conditions vanadyl porphyrins are known to contain 5-coordinate, out-of-plane vanadium(IV). The unusual spectra of vanadyl uroporphyrin in water can be converted to spectra typical of the 5-coordinate vanadyl prophyrins by formation of π-π complexes or by π-π dimerization. Because π-π complex formation and dimerization block addition of an axial sixth ligand a 6-coordinate, in-plane dihydroxide vanadium(IV) uroporphyrin complex is indicated. This hypothesis is consistent with an analysis of the frequencies of the core-size marker lines of metalloporphyrins indicating expansion of the metal core by 0.03 to 0.04 A in $V(OH)_2$UroP. 5 figures.

56156 **Shock-induced activation of acrylamide polymerization.** Dodson, B.W.; Arnold, C. Jr. (Sandia National Labs., Albuquerque, NM). *Journal of Physical Chemistry;* **87**: No. 16, 3023-3024(4 Aug 1983). Contract AC04-76DP00789.

We have subjected polycrystalline acrylamide to planar impact loading to peak pressures of 4.8 and 6.7 GPa using an air-driven projectile. In contrast to previous experiments involving explosive loading, postshock chemical analysis shows no formation of polyacrylamide associated with the shock loading. However, the impact shocked acrylamide spontaneously polymerizes when dissolved in tetrahydrofuran. This result implies that the stress history produced by the impact experiment results in the formation of a large density of stable active centers, which become mobile in solution. ESR measurements of the shocked acrylamide samples confirms the presence of substantial densities of free radicals. 2 figures.

56157 **Vapor pressure isotope effects in liquid methyl fluoride.** Oi, T.; Shulman, J.; Popowicz, A.; Ishida, T. (State Univ. of New York, Stony Brook). *Journal of Physical Chemistry;* **87**: No. 16, 3153-3160(4 Aug 1983). Contract AC02-80ER10612.

The vapor pressures of the isotopic methyl fluorides $^{12}CH_3F$, $^{12}CD_3F$, and $^{13}CH_3F$ have been measured at temperatures between 132.48 and 213.12 K by differential manometric techniques in a precision cryostat. Throughout the whole temperature range of the measurements, $P(^{12}CH_3F) > P(^{12}CD_3F)$ and $P(^{12}CH_3F) < P(^{13}CH_3F)$. The data are best represented by T ln (f/sub c//f/sub g/) = (2225.2 +- 7.4)/T - (4.444 +- 0.046) for the D/H effect and by T ln (f/sub c//f/sub g/) = (56.58 +- 2.09)/T - (0.6383 +- 0.0133) for the $^{13}C/^{12}C$ effect. A series of calculations using Wilson's GF matrix method and a modified Schachtschneider-Snyder program resulted in temperature-dependent internal-external interactions in the liquid phase: Presence of such interactions between the molecular translation in the direction of the molecular figure axis and the parallel normal modes nu_3 and nu_6 is a necessary requirement for satisfactory explanation of all isotopic vapor pressure and spectroscopic data of the liquid. The specific internal-external interactions found are consistent with the structure of CH_3F clusters obtained by ab initio molecular orbital calculations. 5 figures, 8 tables.

56158 **CO isotopic mixing measurements on nickel: evidence for irreversibility of CO dissociation.** Goodman, D.W.; Yates, J.T. Jr. (National Bureau of Standards, Washington, DC). *Journal of Catalysis;* **82**: No. 2, 255-260(Aug 1983).

The isotopic mixing reaction, $^{12}C^{18}O + {}^{13}C^{16}O \rightarrow {}^{12}C^{16}O + {}^{13}C^{18}O$, and the methanation reaction ($3H_2 + CO \rightarrow CH_4 + H_2O$) have been studied at 2 Torr CO pressure over a Ni(100) single crystal between 300 and 700 K. At 600 K the rate of the exchange reaction is a factor of 50 slower than CO hydrogenation indicating irreversibility of the CO dissociation reaction step. Below 850 K, the turnover number for the isotopic mixing reaction is less than 4×10^{-3} reactive events $site^{-1}$ sec^{-1}. This corresponds to a reactive sticking coefficient of $<2 \times 10^{-8}$. The steady state reaction becomes significant at ~ 850 K at which temperature a graphite layer begins to decompose, opening up free Ni sites. Various models to explain these observations are discussed. 4 figures.

56159 **Symmetry-adapted transition-state theory: nonzero total angular momentum.** Miller, W.H. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **87**: No. 15, 2731-2733(21 Jul 1983). Contract AC03-76SF00098.

It is shown how nonzero total angular momentum is incorporated in a recently proposed symmetry-adapted transition-state theory. The analysis is carried through explicitly for the unimolecular dissociation of formaldehyde, $H_2CO \rightarrow H_2 + CO$, for which the transition state is planar, i.e., C/sub s/ symmetry. The main qualitative result for this example is that mode specificity between A′ and A″ states (out of plane vibrational states), i.e., the difference of the rate constant ratio k/sub A′//k/sub A″/ from unity, diminishes with increasing J (angular momentum) but does not completely disappear even in the limit $J \rightarrow \infty$.

56160 **Kinetic perturbation theory. Structure of collision integrals for the square-well gas.** Karkheck, J. (GMI Engineering and Management Inst., Flint, MI); Stell, G. *Journal of Physical Chemistry;* **87**: No. 15, 2858-2866(21 Jul 1983).

We seek a better understanding of the structure of kinetic perturbation theory, in inverse temperature T^{-1}, for fluids. For a prototypic pair potential (hard core of unit diameter plus square well of width R and depth ϵ) we obtain exact results on the Boltzmann-equation level of description. We find the following: (i) for the self-diffusion collision integral $\Omega^{(1\ 1)}$, the nonanalytic terms in $w = \epsilon/kT$ are all of the form w/sup n/ ln w and w/sup n + 1/ $\ln^2$ w, n = 2, 3, 4, ... (ii) $\Omega^{(1\ 1)}$ also has an essential singularity in R at R = 1; (iii) first-order perturbation theory in w is unreasonably ac-

curate. It yields a good approximation for $\Omega(1\ 1)$ (and hence for the coefficient of self-diffusion) over a considerable region of parameter space (R^{-1},w), including domains over which individual higher order terms in w are larger than the first-order terms; (iv) partial sums through $O(w^3 \ln w)$ yield approximations of decreasing accuracy as more terms are included; (v) a result similar to iii is found for the thermal conductivity and its collision integral, though over a more limited region of parameter space; and (vi) the linear term in w and the leading nonanalytic terms are traced to different collision types. The significance of the above findings for perturbative treatments of the dense fluid is discussed. Results are presented also for the simpler cases of coreless square-well and repulsive (square) mound pair potentials. 9 figures.

56161 Poly(ethylene glycols) and poly(ethylene glycol)-grafted copolymers are extraordinary catalysts for dehydrohalogenation under two-phase and three-phase conditions. Kimura, Y.; Regen, S.L. (Marquette Univ., Milwaukee, WI). *Journal of Organic Chemistry;* **48**: No. 2, 195-198(28 Jan 1983).

Poly(ethylene glycols) [HO(CH_2CH_2O)/sub n/H, where n > 3] possess remarkably high activity as catalysts for dehydrohalogenation in organic-aqueous hydroxide two-phase systems, relative to classical phase-transfer agents, i.e., benzyltriethylammonium chloride and 18-crown-6. The importance of terminal hydroxyl groups together with the abrupt increase in catalyst activity and concentration in the organic layer on going from n=2 to n=3 and from n=3 to n=4 suggests the involvement of novel polymeric alkoxides I and/or hydroxides II. Moreover, the fact that maximum activity is obtained with n ≧ 5 implies that an "18-crown-6-like" structure occurring at the terminus of the polymer chain is optimal for catalysis. Poly(ethylene glycols) grafted to cross-linked polystyrene display reasonably high activity. In preparative-scale conversions, such triphase catalysts can be recovered quantitatively by simple filtration and reused without significant loss in activity.

56162 Room-temperature phosphorescence of selected aromatic carboxylic acids adsorbed on silica gel and polyacrylic acid-sodium chloride mixtures. Hurtubise, R.J.; Smith, G.A. (Univ. of Wyoming, Laramie). *Analytica Chimica Acta;* **139**: 315-321(1982). Contract AC02-80ER10624.

Several aromatic carboxylic acids give room-temperature phosphorescence when adsorbed on silica gel chromatoplates that contain a polymeric binder. Terephthalic acid is used as a model compound to investigate the interactions with such chromatoplates and various polyacrylic acid-sodium chloride mixtures. The results indicate that under some conditions, hydrogen bonding appears to be operative, whereas under other conditions room-temperature phosphorescence can be detected without hydrogen bonding interactions. 21 references, 3 tables.

56163 Selectively metalated doubly cofacial porphyrin trimers: new models for the study of photoinduced intramolecular electron transfer. Wasielewski, M.R.; Niemczyk, M.P.; Svec, W.A. (Argonne National Lab., IL). *Tetrahedron Letters;* **23**: No. 32, 3215-3218(1982).

The preparation of a doubly cofacial porphyrin trimer consisting of a Zn mesoporphyrin - Zn mesoporphyrin - mesoporphyrin stack is described. The optical absorption and fluorescence properties of the molecule as a function of solvent are also reported. 12 references, 1 figure, 2 tables.

56164 Structure of 2,4,6-triaminopyrimidine. Schwalbe, C.H.; Williams, G.J.B. (Univ. of Aston, Birmingham, England). *Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry;* **38**: 1840-1843(1982).

$C_4H_7N_5$, M/sub r/ = 125.1, monoclinic, $P2_1/n$,a = 10.348 (3), b = 9.551 (2), c = 12.464 (9) A, β = 112.27 (4)°, U = 1140.0 A^3, Z = 8, D/sub c/ = 14.6, D/sub m/ = 1.45 g cm^{-3}, μ(CuKα) = 8.75 cm^{-1}, final R = 0.107 for 995 independent reflections. Transparent crystals grow from aqueous ethanol/acetone solution as twinned needles with the c repeat parallel to the needle axis. The two independent molecules are nearly planar but deviate up to 0.03 (1) A from the expected local C/sub 2 nu/ symmetry. Molecules are joined into ribbons by N-H...N bonds linking 4- and 6-amino groups to ring nitrogen atoms. Two ribbons associate by π-π interactions between equivalent molecules to form an infinite antiparallel double ribbon; the 2-amino substituents of different molecules approach each other in a manner which suggests they both donate and accept hydrogen bonds. 7 references, 3 figures, 5 tables.

56165 Room-temperature phosphorescence of nitrogen heterocycles and aromatic amines. Ramasamy, S.M.; Hurtubise, R.J. (Univ. of Wyoming, Laramie). *Analytical Chemistry;* **54**: No. 9, 1642-1644(1982). Contract AC02-80ER10624.

Room-temperature phosphorescence (RTP) has generated considerable interest over the past several years. Several materials have been used to induce RTP from a variety of compounds. However, there is still a need to test additional materials and experimental conditions for RTP so the maximum sensitivity and selectivity can be obtained. In this work, three solid surfaces and several experimental conditions were tested for RTP of nitrogen heterocycles and aromatic amines. Nitrogen heterocycles and aromatic amines are an important class of compounds as shown by work in areas such as environmental research and coal liquefaction research. 18 references.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 56126, 56173

56166 Photoelectrochemistry of levulinic acid on undoped platinized n-TiO_2 powders. Chum, H.L.; Ratcliff, M.; Posey, F.L.; Turner, J.A.; Nozik, A.J. (Solar Energy Research Inst., Golden, CO). *Journal of Physical Chemistry;* **87**: No. 16, 3089-3093(4 Aug 1983).

The photoelectrochemistry of levulinic (4-oxopentanoic) acid, the major product of controlled degradation of cellulose by acids, has been investigated. Since this acid can be present in waste streams of biomass processing, we investigated the photoelectrochemical reactions of this acid on slurries composed of semiconductor/metal particles. The semiconductor investigated was platinized undoped n-TiO_2, as anatase, anatase-rutile mixture, or rutile. The effects of the level of platinization, pH, acid concentration, and the semiconductor surface area were investigated. In addition to the decarboxylation reaction leading to methyl ethyl ketone, we have also observed novel cleavages of the C-C backbone leading to propionic acid, acetic acid, acetone, and acetaldehyde as major products. These lower molecular weight carboxylic acids undergo decarboxylation at the slurry diodes to ethane and methane. The organic product distribution is a complex function of the crystallographic phase of n-TiO_2 and of the level of metallization of the semiconductor powder. 2 figures, 1 table.

56167 Kinetics of the hydrogen evolution reaction on mild steel and nickel cathodes in concentrated sodium hydroxide solutions. Brown, A.P.; Krumpelt, M.; Loutfy, R.O.; Yao, N.P. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **129**: No. 11, 2481-2487(Nov 1982).

Data are reported at 288 to 358 K for both smooth and roughened electrode surfaces up to current densities of about 0.3 A/cm^2. Tafel plots for the nickel cathodes are linear over the whole current density range studied. The transfer coefficient, β, has an average value of 0.54 and is unaffected by varying either the caustic concentration, the temperature, or the surface roughness of the electrode. With the mild steel cathodes, the Tafel plots show two linear regions with the inflection point occurring at eta = 0.140 to -0.225 V. In the lower overpotential region, β increases from about 0.5 to at least 1.4 with increasing caustic concentration and increasing temperature. This behavior is interpreted as being caused by a change in reaction mechanism and results from one of the reaction steps becoming reduced in rate. The ability of the caustic concentration or the temperature to affect the reaction mechanism is amplified by roughening the electrode surface. For the linear regions in the Tafel plots at high overpotentials, the slopes are almost invariant to changes in the caustic concentration, the temperature, or the surface roughness. The transition between the two Tafel regions appears to be caused by a change in the electrode surface resulting from the reduction of a surface oxide, possibly FeOH. The dependence of the inflection point potential on the experimental variables is analyzed in terms of this potential being

equivalent to the equilibrium potential of the inferred surface redox reaction.

56168 **Mass transfer at longitudinally vibrating vertical electrodes.** Liu, M.B.; Rudnick, E.M.; Cook, G.M.; Yao, N.P. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **129**: No. 9, 1955-1959(Sep 1982).

Experimental measurements of limiting currents were carried out to determine the increase in mass transfer rates as a result of longitudinal vibrations applied to vertical flat-plate electrodes. Three different lengths of the electrode active areas (1.27, 2.54 5.08 cm), three different vibration amplitudes (0.0572, 0.114, and 0.229 cm), and several different vibration frequencies (ranging from 13 to 36 Hz) were used in the experiments. The current is a sum of a small a-c current and a large d-c current. The a-c current profile, which has a phase lag of 90°, depends on the location of the electrode active area and the vibration parameters. With the experimental conditions used, the average mass-transfer coefficients are in the range of 2.8 - 14 x 10^{-4} cm/s, which represents an increase to 1.2 to 5 times the value for the average free-convective mass-transfer coefficient. A correlation similar to that derived from boundary-layer theory for forced convection over a flat plate is given for predicting the mass-transfer coefficient from the length of electrode active area and the vibration parameters.

56169 **Electrochemical behavior of Al_2S_3 in molten $MgCl_2$ + NaCl + KCl eutectic.** Minh, N.Q.; Loutfy, R.O.; Yao, N.P. (Argonne National Lab., IL). *Journal of Electroanalytical Chemistry;* **131**: 229-242(1982).

The electrochemical behavior of Al_2S_3 in $MgCl_2$ + NaCl + KCl eutectic has been studied at graphite electrodes at 1023 K using the technique of linear sweep voltammetry. The electrolytic decomposition of Al_2S_3 in the eutectic involves the cathodic reduction of aluminum ions (or aluminum-ion-containing species) and the anodic oxidation of sulfide ions (or sulfide-ion-containing species). The reduction has been found to proceed by a reversible, three-electron transfer that forms an insoluble product. The average apparent diffusion coefficient for aluminum ions during deposition is 1.03 x 10^{-5} $cm^2 s^{-1}$. The oxidation involves the two-electron discharge of sulfide ions (S^2 reversible S + 2e), followed by the dimerization of sulfur atoms to S_2 (S + S reversible S_2), which is very fast and very much displaced towards S_2. The average apparent diffusion coefficient for sulfide ions is calculated to be 2.73 x 10^{-5} $cm^2 s^{-1}$. 42 references, 7 figures, 3 tables.

4005 Photochemistry

REFER ALSO TO CITATION(S) 56144, 56155, 56162, 56166

56170 **(DOE/ER/00038—T1) Radiation Laboratory, University of Notre Dame quarterly report, April 1-June 30, 1983.** (Notre Dame Univ., IN (USA). Radiation Lab.). Sep 1983. Contract AC02-76ER00038. 56p. NTIS, PC A04/MF A01. Order Number DE84000531.

Sixty-nine abstracts are included of activities and progress in photochemistry radiation chemistry projects.

56171 **(LBL—15846) Application of chemical modification and spin-labeling techniques to the study of energy conversion by bacteriorhodopsin.** Packer, L.; Quintanilha, A.T.; Mehlhorn, R.J. (Lawrence Berkeley Lab., CA (USA)). Mar 1983. Contract AC03-76SF00098. 13p. (CONF-8209175—1). NTIS, PC A02/MF A01. Order Number DE83017517.

From 2. international conference on water and ions in biological systems; Bucharest, Romania (6 Sep 1982).

Light generates a pH gradient and an electrical potential across the purple membrane of Halobacterium halobium. We are investigating the time-resolved changes in protonation of the side chains of specific amino-acid residues and the correlation of these changes with photon absorption and the ensuing photo-reaction cycle. We seek to determine the precise molecular description of the photocycle and of the time dependent steps in the uptake, translocation, and release of protons by the retinal proton catalyst in this membrane, bacteriorhodopsin (BR). 14 references, 3 figures, 1 table.

56172 **Two-photon laser-assisted reaction with Xe/Cl_2 to form XeCl and with Xe/ICl to form XeCl and XeI.** Ku, J.K.; Inoue, G.; Setser, D.W. (Kansas State Univ., Manhattan). *Journal of Physical Chemistry;* **87**: No. 16, 2989-2993(4 Aug 1983).

Two-photon laser-assisted reactions yielding XeCl(B,C) in 5 to 15-torr Xe/Cl_2 mixtures and XeCl(B,C) and XeI(B,C) in 5 to 15-torr Xe/ICl mixtures have been observed. The order dependence, the time dependence, and the excitation wavelength dependence are consistent with transfer from the ground-state, nonreactive potential to an excited-state, reactive potential followed by chemical reaction. The reactive potential may be the ion pair potential, $V(Xe^+,Cl_2^-)$, or a potential involving electronically excited chlorine, $V(Xe,Cl_2^{**})$, or more likely a mixed potential having character of both states. 3 figures.

56173 **Photooxidation of thiacyanine dyes at ZnO single-crystal electrodes.** Kavassalis, C.; Spitler, M.T. (Mount Holyoke Coll., South Hadley, MA). *Journal of Physical Chemistry;* **87**: No. 16, 3166-3171(4 Aug 1983).

The photooxidation of a series of thiacyanine dyes has been studied at the (1010) face of ZnO single-crystal electrodes by using a total internal reflection technique. These dyes, a thia-n-carbocyanine series where n = 0, 1, 2, 3, were found to produce a photocurrent with an efficiency, PHI/sub p/, of ~ 10^{-2}. Dye aggregate formation and increasing surface coverage of the electrode by the dye also influence PHI/sub p/, causing it, in general, to decline. These data are discussed in the context of a model for dye-densitized photocurrent. 5 figures.

56174 **Laser photolysis of zinc porphyrin dissolved in cyanohexylbiphenyl liquid crystal.** Levanon, H. (Hebrew Univ., Jerusalem, Israel). *Chemical Physics Letters;* **90**: No. 6, 465-471(20 Aug 1982).

A laser photolysis study of ZnTPP (P) oriented in nematic and isotropic cyanohexylbiphenyl (6CB) as a function of added 1,4-benzoquinone (Q) is reported. In the absence of Q, enhancement of triplet absorption below the clearing point (nematic phase) is observed. It is attributed to the improved alignment of the optical transition in the ordered matrix, and also to the increase in the intersystem crossing efficiency, T reverse arrow S_1. In the presence of Q, in the nematic phase, an additional increase in triplet absorption is noticed. This result is interpreted in terms of a triplet radical-pair $[P^+-Q^-]$/sup T,RP/ formation which is facilitated by the ordering in the liquid crystal, thus providing an additional channel for triplet formation. The triplet P/sup T/ in 6CB (nematic or isotropic) is quenched with a second-order rate of $\simeq 10^9$ $M^{-1}s^{-1}$ as compared to 2 x 10^9 $M^{-1}s^{-1}$ in toluene. 20 references, 5 figures, 1 table.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 56103, 56170

56175 **(DOE/ER/02968—150) Studies of radiation-produced radicals and radical ions. Progress report, September 1, 1982-August 31, 1983.** Williams, T.F. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1983. Contract AS05-76ER02968. 17p. NTIS, PC A02/MF A01. Order Number DE83017400.

During the past year, radiation chemical and solid-state ESR techniques were combined to generate and characterize novel radical ions. Observations have been made on a variety of metastable organometallic radical cations derived from Group IV B metal alkyls. Matrix interactions have been discovered between radical cations and the Freon solvent. The radical cation formed from ethylene oxide is the ring-opened 2-oxa-trimethylene cation with a symmetrical C/sub 2v/ planar structure. The CF_3CCl_3 radical was formed after γ irradiation of the CF_3CCl_3 (Freon) matrix. Very large long-range proton hyperfine couplings were found in radical cations of carbonyl compounds. The $C_8F_8^-$ ion was studied in MTHF glass, using ESR. Two new inorganic radicals, SF_4^- and SF_4O^-, were discovered. (DLC)

56176 (ZfI-Mitt—63) **Complex reaction sequence of the thermal and radiolytic degradation of polyvinyl chloride.** Reichert, W. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Mar 1983. 216p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83703428.

The degradation of PVC-foils was been tested by thermal and radiolytic stress in N_2- and O_2-atmosphere. Additionally was determined the influence of plasticizers, Fe-, Zn- and Cu-stearates and other additives, which partially are known as stabilizators. Complex mechanisms of degradation are proposed, which were deduced from the HCl-elimination, consumption of oxygen and the shift of the molmass by the scission and crosslinking of main chains both for PVC as combination of PVC with additives. The mechanism corresponds to other known experimental results, too. It was shown, that the radiolytical degradation caused by radicals, which initiate a radical chain mechanism, if the temperature is higher than the glass temperature (Tg). The thermical degradation in a N_2-atmosphere was explained by an ionic complex mechanism. At the presence of oxygen the ionic mechanism was superimposed by a radical chain mechanism following the oxidation of polyene structures.

56177 **Time-resolved resonance Raman observation of tetrafluoro-p-benzosemiquinone anion radical.** Tripathi, G.N.R.; Schuler, R.H. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* 87: No. 16, 3101-3105(4 Aug 1983).

Time-resolved resonance Raman spectroscopy has been used to examine tetrafluoro-p-benzosemiquinone radical anion produced in the pulse radiolytic oxidation of tetrafluorohydroquinone in aqueous solution. This radical is much more reactive than p-benzosemiquinone and is observed to decay on the millisecond time scale in both Raman and pulse radiolytic experiments. For the Raman experiments excitation was on the red edge of the moderately strong absorption band of this radical at 430 nm. Two resonance-enhanced Raman bands are exhibited at 1556 and 1677 cm^{-1} and are assigned to the in-phase CO and symmetrical CC stretch vibrations. These frequencies are considerably higher than the corresponding values of 1435 and 1620 cm^{-1} observed in this radical's protonated counterpart. The relatively large increase in the CO stretch frequency, in particular, indicates that fluorination induces a substantial increase in the quinoid character of this radical. 3 figures, 1 table.

56178 **One-electron transfer reactions of the couple NAD./NADH.** Grodkowski, J. (Univ. of Notre Dame, IN); Neta, P.; Carlson, B.W.; Miller, L. *Journal of Physical Chemistry;* 87: No. 16, 3135-3138(4 Aug 1983).

One-electron transfer reactions involving nicotinamide-adenine dinucleotide in its oxidized and reducd forms (NAD./NADH) were studied by pulse radiolysis in aqueous solutions. One-electron oxidation of NADH by various phenoxyl radicals and phenothiazine cation radicals was found to take place with rate constants in the range of 10^5 to 10^9 $M^{-1}s^{-1}$, depending on the redox potential of the oxidizing species. In all cases, NAD. is formed quantitatively with no indication for the existence of the protonated form ($NADH^+$.). The spectrum of NAD., as well as the rates of oxidation of NADH by phenoxyl and by $(chlorpromazine)^+$. were independent of pH between pH 4.5 and 13.5. Reaction of deuterated NADH indicated only a small kinetic isotope effect. All these findings point to an electron transfer mechanism. On the other hand, attempts to observe the reverse electron transfer, i.e., one-electron reduction of NAD. to NADH by radicals such as semiquinones, showed that k was less than 10^4 to 10^5 $M^{-1}s^{-1}$, so that it was unobservable. Consequently, it was not possible to achieve equilibrium conditions which would have permitted the direct measurement of the redox potential for NAD./NADH. One-electron reduction of NAD. appears to be an unlikely process. 1 table.

56179 **Radiation chemistry of aqueous purine solutions.** Ali, M.A.A.M. Newcastel Upon Tyne, England; Newcastle upon Tyne University (1982). 164p. British Library, Boston Spa, Wetherby, West Yorks. No. D40967/82.

Thesis.

Gamma-radiolysis of N_2O-saturated hypoxanthine (Hypx) solutions in the absence and in the presence of thiols has been investigated. The yields of the radiolytic products and G(-Hypx) were determined and the effect of thiols on the yield and on G(-Hypx) were investigated. The low G(-Hypx) was attributed to extensive restitution reactions which are taking place in these systems. In both systems the major products are 6-amino-5-formamido-4-oxopyrimidine and hydrated hypoxanthine. The rate constant for the reaction of OH + hypoxanthine of 3.1 x 10_9dm.^{3}mol.$^{-1}$s.$^{-1}$ has been determined using competition with tartarate. Pulse radiolysis of N_2O-saturated hypoxanthine solutions showed the presence of at least two Hypx OH adducts, these decaying by second order kinetics. Possible mechanism for the reactions of the Hypox OH adducts in these systems are discussed.

56180 **Optical response of excess electrons in dielectric liquids.** Funabashi, K. (Univ. of Notre Dame, IN). *Journal of Electrostatics;* 12: 65-71(1982).

The theoretical basis for describing the optical absorption spectrum of the trapped electron in polar and non-polar liquids is critically examined. The choice of the degenerate vibronic wavefunctions as zero-th order basis wavefunctions leads to a unified description of the absorption spectrum and the d.c. mobility through the use of the Kubo formula. On the other hand, a set of one-center vibronic wavefunctions of the Landau-Jortner formulation are shown to give a narrower line shape and zero d.c. mobility if one imposes the adiabatic approximation. A new interpretation of the uv response is also given.

56181 **Relative reducibilities of complexes of Fe(III), Co(III), Mn(III) and Cu(II) with apotransferrin using e/sub aq/$^-$ and CO_2.** Sommer, J.H. (Columbia Univ., New York, NY); O'Hara, P.B.; Jonah, C.D.; Bersohn, R. *Biochimica et Biophysica Acta;* 703: 62-68(1982).

Metal complexes of transferrin with iron (III, cobalt (III), manganese (III) and copper (II) were exposed to the short-lived, extremely powerful reductants e/sub aq/$^-$ and CO_2^-. The amount of reduction of the metal ions was measured by the bleaching of the visible charge-transfer absorbance. All of the complexes show less than 7% metal reduction. A kinetic model was formulated and reductive rate constants derived for each complex. The rate constants were of the order 10^8 $M^{-1}s^{-1}$ for e/sub az/$^-$ and 10^6 $M^{-1}s^{-1}$ for CO_2^-. Although these rate constants are almost 10 orders of magnitude faster than those determined for transferrin with conventional chemical reductancts, they are 2 to 4 orders of magnitude slower than those for aquo and other protein complexes of the same metal ions. Iron transferrin, the biologically important species, is 2 to 3 times less reducible than any of the other complexes, which is explained by a small structural difference. Direct reduction as a mechanism for iron release in the reticulocyte seems unlikely in view of the results mentioned above. 24 references, 3 tables.

4007 Radiochemistry And Nuclear Chemistry

56182 (ARL/TR—050, pp 77-80) **Technetium-99m dithiocarbamates: the development of a new hepatobiliary agent.** Baldas, J.; Pojer, P.M. Jan 1983. NTIS (US Sales Only), PC A08/MF A01.

In Annual review of research projects 1981.

Preparation of dithiocarbamato liganda, preparation of sup(99m)Tc-dithiocarbamato complexes and physical properties of these complexes are discussed. The in vivo distribution of the complexes in mice correlated with their polarity. The lipophilic complexes were rapidly extracted by the liver and were then either retained or were slowly excreted. The soluble, polar complexes were characterised by slow blood clearance which occurred concurrently with rapid liver excretion. The ethylenebis (dithiocarbamato) complex enabled gallbladder visualisation over a period greater than two and a half hours.

56183 (ARL/TR—050, pp 81-83) **Magnetically responsive particles labelled with technetium-99m and phosphorus-32.** Lichtenstein, M.; Pojer, P.M.; Spokas, R.J. Jan 1983. NTIS (US Sales Only), PC A08/MF A01.

In Annual review of research projects 1981.

An improved method for labelling a variety of magnetic particles with technetium-99m has been developed. The particles were

then labelled with phosphorus-32 and biodistribution under the influence of a magnetic field was investigated. The preparation is a model of a radiotherapeutic agent.

56184 (EUR—7700DE) Contributions to radiochemical and nuclear materials research. Matzke, H. (Commission of the European Communities, Luxembourg). 1982. 188p. (In German). Available from Commission of the European Communities, Luxembourg.

The contributions of the seminary present reflexions on research and practice, some new trends in self-diffusion in ionic crystals and ceramics, the business with special chemicals, application of radioisotopes in motor-car industry, science and prognosis, intermediate storage of deflagrated fuel rods of KNK II, studies on Actinide Chemistry and solvent extraction, increased uranium self-diffusion in UOsub(2+x) and (U,Nb)Osub(2+-x), the story of MX processer, contact adhesive chemistry and localization of impurity atoms at crystal surfaces by lattice leading. No separate abstracts were prepared for the 15 lectures in this report.

56185 Studies with Pt-195M platinum complexes. Cole, W.; Wiza, J.; Odenheimer, B.; Wolf, W. (University of Southern California, Los Angeles (USA)); Hoeschele, J.D.; Butler, T.A. (Oak Ridge National Lab., TN (USA)); Smyth, R.D. (Bristol Labs., Syracuse, NY (USA)). *Journal of Labelled Compounds and Radiopharmaceuticals;* **19**: No. 11-12, 1400-1402(Nov-Dec 1982). (CONF-8208101—).

From 4. international symposium on radiopharmaceutical chemistry; Juelich, F.R. Germany (23 Aug 1982).

Cis-diamine-ethylmalonato ^{195}Pt(II) has been synthesised to investigate its chemotherapeutic potential in cancer and other diseases. It is likely to be less nephrotoxic than the established drug crisplatin. Biodistribution and clearance studies were carried out on Sprague-Dowley rats after intravenous administration of the new drug.

56186 Recoil ^{18}F chemistry. Superexcited molecules from non-thermal F-for-F substitution in CF_4. Knickelbein, M.B.; Knierim, D.; Mathis, C.A.; Root, J.W. (Univ. of California, Davis). *Chemical Physics Letters;* **86**: No. 5-6, 510-514(5 Mar 1982). Contract AM03-76SF00034.

Nuclear recoil F-for-F substitution reactions have been studied in gaseous CF_4 over the effective pressure range 1.0 to 44.5 kTorr. At 1.0 kTorr 76.7% of the initially formed CF_3 ^{18}F undergoes secondary decomposition and 12.4% undergoes 20.4 eV endoergic complete dissociative atomization. An approximate phenomenological technique is described for characterizing the CF_3 ^{18}F excitation energy probability density distribution. 22 references, 2 figures, 2 tables.

56187 Chemical properties of the heavier actinides and transactinides. Hulet, E.K. (Lawrence Livermore National Lab., CA). pp 453-490 of Actinides in perspective. Edelstein, N.M. (ed.). New York, NY; Pergamon Press (1982). Contract W-7405-ENG-48.

The chemical properties of each of the elements 99 (Es) through 105 are reviewed and their properties correlated with the electronic structure expected for 5f and 6d elements. A major feature of the heavier actinides, which differentiates them from the comparable lanthanides, is the increasing stability of the divalent oxidation state with increasing atomic number. The divalent oxidation state first becomes observable in the anhydrous halides of californium and increases in stability through the series to nobelium, where this valency becomes predominant in aqueous solution. In this range of elements, the II → III oxidation potential decreases from +1.5 to -1.5 volts. These observations lead to the conclusion that, in comparison with the analogous 4f electrons, the 5f electrons in the latter part of the series are more tightly bound. Thus, there is a lowering of the 5f energy levels with respect to the Fermi level as the atomic number increases. The metallic state of the heavier actinides has not been investigated except from the viewpoint of the relative volatility among members of the series. In aqueous solutions, ions of these elements behave as normal trivalent actinides and lanthanides (except for nobelium). Their ionic radii decrease with increasing nuclear charge which is moderated because of increased screening of the outer 6p electrons by the 5f electrons. The actinide series of elements is completed with the element lawrencium (Lr) in which the electronic configuration is $5f^{14}7s^27p$. From Mendeleev's periodicity and Dirac-Fock calculations, the next group of elements is expected to be a d-transition series corresponding to the elements Hf through Hg. The chemical properties of elements 104 and 105 only have been studied and they indeed appear to show the properties expected of eka-Hf and eka-Ta. 103 references, 15 figures, 9 tables.

56188 Enthalpy and heat capacity of the actinide oxides. Fink, J.K. (Argonne National Lab., IL). *International Journal of Thermophysics;* **3**: No. 2, 165-200(1982).

The available enthalpy data on UO_2, ThO_2, PuO_2, (Th, U)O_2, and (Pu, U)O_2 have been analyzed and equations have been derived to fit the data. Phase transitions were found in UO_2, ThO_2 (Th, U)O_2, and (Pu, U)O_2. The high temperature PuO_2 data were too scattered to determine whether a phase transition exists. Above the phase transition temperature, the enthalpy data were fit with a linear equation. Enthalpy data for PuO_2 and ThO_2 below the phase transition temperature were fit with two-term equations whose contributions are due to phonons and thermal expansion. For UO_2 below its phase transition, a term for an electronic contribution was added to this basic equation. Below the phase transitions for (Th, U)O_2, enthalpy data were fit by a mole average of the equations used to fit the ThO_2 and UO_2 data below their phase transitions; however, the mole average equation was not valid for 90 and 92% ThO_2 in the mixed oxide. Since it was found that mole averages of the PuO_2 and UO_2 data do not fit the (Pu, U)O_2 data, these data were fit with an equation of the same form as that used for UO_2. 51 references, 14 figures, 7 tables.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 56140, 56246, 56299

56189 (AD-A—127803/5) Two-point Rayleigh scattering measurements in a v-shaped turbulent flame. Interim report. Namazian, M.; Talbot, L.; Robben, F.; Cheng, R.K. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). Sep 1982. 23p. NTIS, PC A02/MF A01.

A Rayleigh scattering technique for simultaneous measurements of density at two points in a flame was developed. This technique was used to deduce the spatial and time-space correlation and the two-point joint probability density functions of the density in a premixed turbulent flame in three orthogonal directions. A grid generated turbulent V-shaped flame at a flow velocity of 7.0 m/s and a half angle of 12 degree was used. The analysis show that this flame consists of structures of equal length scale in all three directions which decay as they are convected downstream by the flow. It is also shown that this flame does not consist of flamelets.

56190 (AD-A—127945/4) Noise thermometry measurements in combustion processes. Final report 30 Jun 81-29 Jun 82. Gill, S.P.; Shimmin, W.L.; Watson, J.D. (Artec Associates, Inc., Hayward, CA (USA)). Jan 1983. 57p. NTIS, PC A04/MF A01.

Experiments are described in which the temperature of combustion gases is measured by directly sensing the thermal noise emissions from the flowing gases. The temperatures measured by the noise thermometer are compared to reference thermocouple readings. Within the limitations of the reference thermocouple and the accuracy of the noise thermometer calibration standards, the temperature determined by direct noise thermometry appears to represent the true gas temperature and is uncomplicated by contaminating sources of electromagnetic noise.

56191 (DOE/ER/10964—T2) Computation of turbulent reacting flows: comparison of various mixing/chemistry interaction models. Wormeck, J.J. (Dynamics Technology, Inc., Torrance, CA (USA)). Sep 1983. Contract AC03-81ER10964. 202p. NTIS, PC A10/MF A01. Order Number DE84000998.

This report compares various mixing/chemistry interaction models for turbulent combustion. Four different models are considered, three of which were developed previously: (1) chemical equilibrium model; (2) finite-rate chemistry model using mean values; and (3) probability density function (PDF) approach with infinite-rate chemistry. The fourth method is called the contact index model, in which the turbulent-chemistry correlations are modeled by PDF and then solved in the finite-rate chemistry formulation of model (2). The chemistry correlations result from Reynolds decomposing the thermochemical equations and can be combined into a contact index for each reaction. All of these combustion models are fully coupled to existing two-dimensional hydrodynamic codes, including steady and unsteady full Navier-Stokes equations and boundary layer equations. Results are compared to experiment for various types of reacting flows. Model (1) is used primarily to provide a simple, low cost initial estimate of the combustion process. It typically produces results that do not compare well with experiment. Model (2) gave satisfactory predictions for high intensity combustion if the results do not depend on finite-rate micro-mixing. If the chemistry is very fast, model (3) gives adequate results. For situations where both finite-rate chemistry and finite-rate micro-mixing are important, such as species NO, H_2, CO predictions, model (4) gives the best agreement with experiment.

56192 **(N—8323547) A mathematical model of a large open fire.** Harsha, P.T.; Bragg, W.N.; Edelman, R.B. (Science Applications, Inc., Chatsworth, CA (USA)). Apr 1981. 80p. (NASA-CR—166475). NTIS, PC A05/MF A01.

A mathematical model capable of predicting the detailed characteristics of large, liquid fuel, axisymmetric, pool fires is described. The predicted characteristics include spatial distributions of flame gas velocity, soot concentration and chemical specie concentrations including carbon monoxide, carbon dioxide, water, unreacted oxygen, unreacted fuel and nitrogen. Comparisons of the predictions with experimental values are also given.

56193 **(NP—3770372) SFB 85 - progress report for the years 1980/81/82.** (Stuttgart Univ. (Germany, F.R.). Sonderforschungsbereich 85 Thermodynamische und Stroemungsmechanische Probleme der Luft- und Raumfahrtantriebe). 1982. 654p. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE83770372.

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This volume contains the reports of the sub-projects of the "Sonderforschungsbereich 85 (SFB 85), that were sponsored in the years 1980, 1981, and 1982. The project groups are named as follows: Elementary processes and diagnostic methods, Processes and numerical methods, and application for components and systems. Some of the 18 articles are recorded separately under special title in this data base.

56194 (NP—3770372, pp 47-86) **Sub-project A3: Flame diagnostics by electron beam fluorescence.** Just, T.; Eberius, H. 1982. (In German). NTIS (US Sales Only), PC A99/MF A01.

In SFB 85 - progress report for the years 1980/81/82.

The method of electron beam fluorescence is applied for the first time as a diagnostic tool to study problems of reaction kinetics. Using this method the time evolution of selected chemical reactions of gas additions in H_2/O_2 low-pressure flames (Psub(tot) = 12 torr) could be investigated. The consumption and the formation of specific reactants in the flame are studied without any influence on the flame. The reaction $N_2O + H \rightarrow N_2 + OH$ is a demonstration for the applicability of the method for gas streams with chemical reactions. Before the successfull application of the method to the present reaction, a series of preliminary experiments have been performed, as up to now the method has mainly been applied to low-pressure ($p < 0.5$ torr) nitrogen and air streams at low temperatures ($T <$ room temperature).

56195 (NP—3770372, pp 87-121) **Sub-project A4: Flame diagnostics by Raman spectroscopy.** Just, T.; Stricker, W. 1982. (In German). NTIS (US Sales Only), PC A99/MF A01.

In SFB 85 - progress report for the years 1980/81/82.

For precise investigations of the chemical and the kinetic behaviour of combustion processes and for the determination of concentration and temperature profiles in flows with simultaneous reactions, diagnostic methods are of interest, which allow measurements, without any influence on the flow and reaction parameters. Reliable experiment data are essential for a better understanding of the reaction mechanisms and lead to improved models and better theoretical predictions. In the subproject A4 a method for temperature and concentration measurements based on the spontaneous Raman effect has been developed and applied in different studies of flame kinetics. Application oriented aspects, such as resolution, measuring time and limits of application have been of special interest in these investigations.

56196 (NP—3770372, pp 150-180) **Sub-project A8: Flame diagnostics by coherent antistokes raman scattering (CARS).** Just, T.; Stricker, W.; Kreutner, W. 1982. (In German). NTIS (US Sales Only), PC A99/MF A01.

In SFB 85 - progress report for the years 1980/81/82.

The subproject A8 "flame diagnostics by coherent antistokes Raman scattering" (CARS) is supported by the SFB 85 until 1980. In the present report results are presented which have been obtained up to July 1982. Part of the experimental equipment and valuable experience have been received from the subproject A4 "flame diagnostics by Raman spectroscopy" which has been finished in the meantime. The aim of this work is to point out the experimental possibilities and limitations of the CARS method for investigations of technical flames. Of special interest are questions on the applicability (design of a reliable optical set-up, system of optimisation of the spacial resolution), interpretation and evaluation of the complex CARS-spectra (influence of linewidth, pressure, nonresonant background) and the maximum precision, which can be obtained for the temperature measurements.

56197 (NP—3770372, pp 183-219) **Sub-project B3: Process and numerical methods in combustion research.** Algermissen, J.; Hildebrand, F.; Kasal, P.; Bauch, H. 1982. (In German). NTIS (US Sales Only), PC A99/MF A01.

In SFB 85 - progress report for the years 1980/81/82.

In this project a detailed experimental analysis has been worked out of the processes in the combustion of mixtures of hydrogen, hydrocarbons, and air under technical reaction conditions. The spatial resolution of the reaction zone is effected by the use of a supersonic flow. In addition, the peculiarities in shock-induced supersonic combustion are presented, which are of special interest for the development of jet engines for high-velocity flight systems. The methods of mass spectroscopy and Raman spectroscopy used in these studies have been further improved.

56198 **Combustion: a true interaction of fluid dynamics, chemical kinetics, heat transfer, and mass transfer.** Churchill, S.W. (Univ. of Pennsylvania, Philadelphia). *Annals of the New York Academy of Sciences;* **404**: 184-193(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

Illustrative recent work and challenging problems in the field of combustion were identified for modeling. Recent progress in several aspects of the modeling of combustion is illustrated for selected processes. The idealizations of infinite reaction rates, local partial equilibrium, global kinetics, and a stationary state for free radicals should now be avoided or justified. Generally, diffusive, convective, and radiative mechanisms are all significant in combustion and, frequently, turbulent transport and buoyant mechanisms as well.

56199 **Structure and stability of laminar flames.** Sivashinsky, G.I. (Univ. of California, Berkeley). *Annals of the New York Academy of Sciences;* **404**: 210-215(1983). (DOE/ER/12020—1; CONF-8206187—). Contract AC03-76SF00098.

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

The propagation and structure of a plane laminar flame is discussed. Equations for propagation velocity are given. Cellular flames and spinning flames are considered. An equation describing the nonlinear evolution of the flame front in hydrodynamic instability is given.

42 ENGINEERING

4201 General Engineering

REFER ALSO TO CITATION(S) 56794

56200 (EGG-MS—6387) Workshop on long-range planning and thrust research areas for the DOE/BES Engineering Research Program. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1983. Contract AC07-76ID01570. 18p. NTIS, PC A02/MF A01. Order Number DE84000491.

Recommendations from the workshop include immediate and significant expansion of a core program, which supports a broad range of research topics by individual contributors from any type of organization, and addition of activities in focused thrust research areas. The three highest priority thrust areas are advanced industrial processes, advanced methods of engineering analysis, and failure control. (LEW)

56201 (UCRL—89746) Introduction to Flexible Manufacturing Systems: their applications, classification, and opportunities. Sutton, G.P. (Lawrence Livermore National Lab., CA (USA)). 20 Sep 1983. Contract W-7405-ENG-48. 31p. (CONF-8309159—1). NTIS, PC A03/MF A01. Order Number DE83017373.

From Flexible Manufacturing Systems-West seminar; Anaheim, CA, USA (20 Sep 1983).

A Flexible Manufacturing System (FMS) is an automatic manufacturing system consisting of several types of automated fabrication equipment and a common material handling system, supervised by a common computer and designed to randomly manufacture or assemble products belonging to a common part family. The FMSs are essentially limited in their applications to discrete mechanical type hardware, such as the fabrication of metal parts, the assembly of components, or the manufacture and inspection of hard goods. The FMS grouping can be classified in various ways into modules, cells or work cells, and more complex systems. Two kinds of opportunities are discussed: the opportunity to design and acquire an FMS so it gives the maximum benefits to the user, and the opportunities for the FMS builders to take advantage of a growing market. (LEW)

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 55490, 55491, 55729, 55768, 55769, 55957, 56234, 56267, 56746

56202 (AD-A—129699/5) Brushless superconducting generator. Final report Apr 79-Jun 82. Mawardi, O.K.; Ferendeci, A.M. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Electrical Engineering and Applied Physics). Oct 1982. 71p. NTIS, PC A04/MF A01.

This report covers work on a flux pump excited brushless superconducting alternator. The flux pump, used to provide the excitation current of the field coils incorporates several features of a machine studied theoretically and reported in an earlier paper. The flux pumping is achieved with six electromagnets having pole pieces of special configurations to yield high efficiency and rapid pumping rates. The maximum design values for the current in the pump is 1,300 amps and for the rational speed, 500 rpm. Sensors installed on the generator yield information on the spatial and temporal behavior of the magnetic field in the flux spot and on the operational characteristics of the pump. The preliminary observations are compared with theoretical predictions.

56203 (BNL—33602) Influence of stabilizing copper on the quench characteristics of Nb_3Sn wire. Tsuchiya, K.; Suenaga, M. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 8p. (CONF-830841—22). NTIS, PC A02/MF A01. Order Number DE83018187.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

Recently there have been some attempts to construct 10-T dipole magnets using Nb_3Sn conductors. Nb_3Sn multifilamentary wires with very high current densities J/sub c/ [above 1000 A/mm^2 at 10 T (excluding Cu)] are commercially available. However, few studies have been made of the electromagnetic stability of these Nb_3Sn wires, and it is not clear how much copper is required for stabilization of the conductor for these magnets. This paper investigated the influence of the amount of stabilizing copper in a Nb_3Sn conductor on the quench energies and quench propagation velocities of Nb_3Sn multifilamentary wires at high magnetic fields. 6 figures.

56204 (LA-UR—83-2579) Electrical and thermal modeling of railguns. Kerrisk, J.F. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 5p. (CONF-8310164—2). NTIS, PC A02/MF A01. Order Number DE84001361.

From 2. symposium on electromagnetic launch technology; Boston, MA, USA (11 Oct 1983).

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Electrical and thermal modeling of railguns at Los Alamos has been done for two purposes: (1) to obtain detailed information about the behavior of specific railgun components such as the rails, and (2) to predict overall performance of railgun tests. Detailed electrical and thermal modeling has concentrated on calculations of the inductance and surface current distribution of long parallel conductors in the high-frequency limit and on calculations of current and thermal diffusion in rails. Inductance calculations for various rail cross sections and for magnetic flux compression generators (MFCG) have been done. Inductance and current distribution results were compared with experimental measurements. Two-dimensional calculations of current and thermal diffusion in rail cross sections have been done; predictions of rail heating and melting as a function of rail size and total current have been made. An overall performance model of a railgun and power supply has been developed and used to design tests at Los Alamos. The lumped-parameter circuit model uses results from the detailed inductance and current diffusion calculations along with other circuit component models to predict rail current and projectile acceleration, velocity, and position as a function of time.

56205 (N—8324798) A refrigerated dynamic seal. Hendricks, R.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. 10p. (CONF-830841—25; NASA-TM—83378; E—1649). NTIS, PC A02/MF A01.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

A new sealing concept is proposed where the fluid to be sealed flows through a refrigerated housing or constriction, is frozen to the housing during the transient phase, and under steady state conditions provides a dynamic seal with essentially 'zero' leakage.

56206 (N—8324861) Study on sealing characteristics of high speed, face-contact bellows mechanical seals for liquid hydrogen. Nosaka, M.; Kamijo, K.; Suzuki, M.; Kikuchi, M.; Miyakawa, Y. (National Aerospace Lab., Chofu, Tokyo (Japan)). 1982. 78p. (In serveral languages). (NAL-TR—750; ISSN—0389-0010). NTIS, PC A05/MF A01.

A high speed, face contact bellows mechanical seal for a liquid hydrogen turbopump of a liquid oxygen (LOX) and liquid hydrogen (LH2) rocket engine was developed. The results of experimental and analytical studies on the static and dynamic sealing performance and the wear process of a developed mechanical seal for an LH2 turbopump is described. The starting torque and static sealing performance were markedly affected by the change of the stationary seal face distortion, which was caused by fluid pressure and temperature, due to wear. The seal friction loss power fell by a small value after the mechanical seal faces had completely run-in. The sealing balance ratio of the mechanical seal, which stabilized the dynamic sealing at high rotative speed, was above 0.77. This high value was due to the large amount of the opening force.

56207 **(N—8324881) The 17th Aerospace Mechanisms Symposium.** (Jet Propulsion Lab., Pasadena, CA (USA)). May 1983. 390p. (CONF-8305136—; NASA-CP—2273). NTIS, PC A17/MF A01.

From 17. Aerospace Mechanisms symposium; Pasadena, CA, USA (5 May 1983).

The proceedings of the Aerospace Mechanisms Symposium are reported. Technological areas covered include space lubrication, aerodynamic devices, spacecraft/Shuttle latches, deployment, positioning, and pointing. Devices for spacecraft tether, magnetic bearing suspension, explosive welding, and a deployable/retractable mast are also described. For individual titles, see N83-24882 through N83-24906.

56208 **(NUREG—0383-Vol.1-Rev.6) Directory of certificates of compliance for radioactive materials packages. Volume 1. Summary report of NRC approved packages. Revision 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Fuel Cycle and Material Safety). Sep 1983. 432p. NTIS, PC A19/MF A01 - GPO $8.50. Order Number DE84900035.

This directory contains a Summary Report of the US Nuclear Regulatory Commission's Approved Packages (Volume 1), all Certificates of Compliance (Volume 2), and Summary Report of NRC Approved Quality Assurance Programs (Volume 3) for Radioactive Material Packages effective September 14, 1983.

56209 **(SAND—82-1927C) Thermal and structural code evaluation.** Trujillo, A.A.; Cline, D.D.; Gwinn, K.W.; Lewis, B.A.; Nelsen, J.M.; Budden, M.J.; Friley, J.R. (Sandia National Labs., Albuquerque, NM (USA); Pacific Northwest Lab., Richland, WA (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-830528—59). NTIS, PC A02/MF A01. Order Number DE84000137.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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The first phase involved code inventories and evaluations which were conducted by the Sandia National Laboratories, Albuquerque, New Mexico and Battelle Pacific Northwest Laboratories, Richland, Washington. Each lab inventories a number of existing thermal and structural codes that were publicly available. Once the codes were inventoried they were reviewed to obtain as much information regarding each code's capability as possible. Codes were then selected for further evaluation against test problems. The second phase involved the definition of the model problems. The two labs developed a number of thermal and structural model problems, against which the codes would be evaluated. These model problems were to be simple, involve most of the important thermal and structural physical parameters, and be cask-like in nature. The third phase involved the development of the consensus solutions for the model problems. The codes were applied to the model problems, with each of the labs working independently, and solutions obtained. The results for each model problem were then compared and any differences resolved. Once the reasons for differences were understood and agreement on solutions was obtained, these results were adopted as those to which all subsequent code results would be compared during the information exchange phase. The fourth phase of this activity involves a transfer of information between SNL/TTC and the nuclear material transportation community. This phase will consist of at least two information exchange meetings.

4203 Lasers

REFER ALSO TO CITATION(S) 56254, 56256

56210 **(AD-A—127837/3) Pulsed laser device development program: mirror development for pulsed lasers. Test report 1 Jul-30 Sep 81.** Smith, M.J. (Avco-Everett Research Lab., Everett, MA (USA)). Apr 1982. 31p. NTIS, PC A03/MF A01.

Surface diagnostic techniques were reviewed to determine if new or novel methods could help achieve an understanding of the laser mirror pulsed fluence failure problem. Dye penetrants were found ineffective, but ultrasonic baths appear to be useful to remove weakly attached surface regions. Acoustic and thermal wave microscopy appear relevant, but could not be experimentally evaluated in this work. Various coppers and copper alloy samples were procured and examined. A sputtered dispersion-hardened alloy of 1% SiC in copper was found to have superior uniformity in composition and hardness, and produced a polished surface superior to those previously obtained at Avco with OFHC copper.

56211 **(AD-A—127845/6) Pulsed laser device development. diagnostic techniques for pulsed laser beam jitter measurement. Test report, 1 Oct 81-30 Jan 82.** Cronburg, T.L. (Avco-Everett Research Lab., Everett, MA (USA)). Apr 1982. 50p. NTIS, PC A03/MF A01.

Beam jitter diagnostics were developed and tested on a repped-flowing CO_2 e-beam sustainer laser cavity. The limiting source of jitter was found to be due to gas density gradients in the cavity. Both flow-induced gradients and disturbances from the repped discharge contribute. Reduction of the jitter magnitude can be accomplished through temperature control of the gas flow and acoustic suppression.

56212 **(AD-A—127926/4) Pulsed laser device development program. volume IV. ABEL II (air-breathing electric laser ii) preliminary beam quality test report. Final technical report 31 Dec 79-30 Sep 81.** Smith, M.J. (Avco-Everett Research Lab., Everett, MA (USA)). May 1981. 85p. NTIS, PC A05/MF A01.

Single-pulse beam quality was measured on the ABEL laser, for output energies in the 2.0-2.8 kj range. No device adjustments or modifications to optimize beam quality were undertaken. Quantities measured were near-field intensity and total energy, farfield intensity and total energy, and fluence distribution in the focal spot region. This last measurement utilized pulsed IR photography, a new and promising technique. Comparsion cavity interferograms were also taken. Energy delivery from near-field to farfield was 60-65%, and was not dependent on laser output energy, flow rate, or resonator configuration. The intensity measurements showed a tendency for farfield intensity at the end of the optical pulse to decay sooner than that of the near-field. Beam quality, as measured by fraction of farfield energy within the first Airy disc, was equal to or less than 1.25 times diffraction limited for four shots analyzed in detail. Astigmatism was the largest contributor to the observed focal spot distortion. Cavity interferometry results predicted beam quality of 1.15 times diffraction limited.

56213 **(AD-A—128033/8) High efficiency picosecond pulse generation in the 675-930 nm region from a dye laser synchronously pumped by an argon-ion laser. Technical report.** Bado, P.; Dupuy, C.; Wilson, K.R.; Boggy, R.; Bowen, J. (California Univ., San Diego, La Jolla (USA). Dept. of Chemistry). Apr 1983. 11p. (TR—13). NTIS, PC A02/MF A01.

Picosecond pulses tunable from 675 to 930 micrometers have been obtained from a dye-laser synchronously pumped at 514.5 micrometers by a mode-locked Argon-ion laser. Peak energy conversion efficiencies between 10% and 29% are observed with pulse durations between 1.7 ps and 16 ps as measured by autocorrelation.

56214 **(AD-A—128037/9) Modification to a flashlamp-pumped dye laser to increase stability of the spatial mode. Final report.** DeWilde, M.A.; Decker, L.J. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). May 1983. 13p. (ARBRL-MR—03265). NTIS, PC A02/MF A01.

It was determined by Fitzpatrick and Piepmeier that the spatial mode structure of the beam from a CMX-4 dye laser (Chromatix, Sunnyvale, CA) could be stabilized by maintaining a precise relationship between dye loop and cooling water loop temperatures. A passive modification to the laser is described that eliminates the active heating and cooling mechanisms that were employed by the initial investigators to accomplish this.

56215 (N—8323588) Research on solar pumped liquid lasers. Schneider, R.T.; Kurzweg, U.H.; Cox, J.D.; Weinstein, N.H. (Florida Univ., Gainesville (USA)). Mar 1983. 34p. (NASA-CR—170298). NTIS, PC A03/MF A01.

A solar pumped liquid laser that can be scaled up to high power (10Mw CW) for space applications was developed. Liquid lasers have the inherent advantage over gases in that they provide much higher lasant densities and thus high power densities. Liquids also have inherent advantages over solids in that they have much higher damage thresholds and are much cheaper to produce for large scale applications. Among the liquid laser media that are potential candidates for solar pumping, the POC13:Nd(3+):ZrC14 liquid was chosen for its high intrinsic efficiency as well as its relatively good stability against decomposition due to protic contamination. The development and testing of the laser liquid and the development of a large solar concentrator to pump the laser was emphasized. The procedure to manufacture the laser liquid must include diagnostic tests of the solvent purity (from protic contamination) at various stages in the production process.

56216 (N—8323589) Free-electron laser from wave-mechanical beats of 2 electron beams. Final Report. Lichtenstein, R.M. (Rensselaer Polytechnic Inst., Troy, NY (USA)). 1982. 178p. (NASA-CR—170291). NTIS, PC A09/MF A01.

It is possible, though technically difficult, to produce beams of free electrons that exhibit beats of a quantum mechanical nature. (1) the generation of electromagnetic radiation, e.g., light, based on the fact that the beats give rise to alternating charge and current densities and a frequency shifter, based on the fact that a beam with beats constitutes a moving grating. When such a grating is exposed to external radiation of suitable frequency and direction, the reflected rediation will be shifted in frequency, since the grating is moving. A twofold increase of the frequency is readily attainabile. It is shown that it is impossible to generate radiation, because the alternating electromagnetic fields that accompany the beats cannot reform themselves into freely propagating waves. The frequency shifter is useless as a practical device, because its reflectance is extremely low for realizable beams.

56217 A scanning system for mapping gas flow uniformity in a laser. Neumann, D.K. US Patent Application 6-475,436. [nd]. Filed date 15 Mar 1983. 11p.

A scanning system for mapping the degree of uniformity of gas flow in the cavity of a laser includes a carriage mounted for movement along a aset of parallel tracks disposed along a side of the laser cavity. The carriage mounts an infrared detector in radiation receiving relationship with the laser cavity. A screw drive mechanism is drivingly coupled to the carriage for moving it in opposite directions on the tracks. Spaced windows along the side of the laser cavity allows passage of radiation from the laser cavity to the detector. Because of the alternating relationship between transmissive windows and non-transmissive plates which defined the windows, successive portions of a voltage signal generated by the detector representing separate measurements can be easily identified with successive positions of the carriage along the laser cavity where each measurement was taken.

56218 Magnetically induced laser. Barrett, T.W. US Patent Application 6-474,607. [nd]. Filed date 11 Mar 1983. 15p.

A laser is described for generating a coherent output beam with a frequency equal to the sum or difference of the frequencies of two input pumping beams or the harmonics thereof. The laser includes a lasing medium of the type with an inverse Faraday effect resonance frequency f1, a laser cavity with the lasing medium positioned therein, two coherent light sources for generating pumping beams at frequency f1 and f2, where the f1 beam is circularly polarized, and an optical system for directing the pumping beams into the lasing medium.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 55392, 55736, 55746, 55747, 55770, 55800, 55801, 55802, 55803, 55804, 56118

56219 (DOE/ER/12020—1) Fourth international conference on physicochemical hydrodynamics. Annals of the New York Academy of Sciences, Volume 404. Pfeffer, R. (ed.). (New York Academy of Sciences, New York (USA)). 1983. Contract FG02-82ER12020. 548p. (CONF-8206187—). NTIS, PC A23/MF A01. Order Number DE83012765.

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

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The name Physicochemical Hydrodynamics (PCH) was given to the class of problems related to the influence of fluid flow on chemical or physical transformations and to the influence of physicochemical factors on fluid flows. PCH has grown rapidly and its approach - combining the most sophisticated methods of modern theoretical and experimental physics and chemistry with the theory of fluid mechanics - has been applied to such diverse areas as mass and heat transfer in moving media, turbulence phenomena, interface mechanics, flow of non-Newtonian fluids, combustion, and flow in biological systems. The interdisciplinary character of PCH, its rapid development, and its many industrial applications makes conferences among physicists, hydrodynamicists, chemists, and engineers - all of whom are involved in solving the problems of PCH - most desirable. The major goal of these conferences is to expose engineers and applied scientists to the major results of theoretical and experimental investigations obtained recently, as well as to expose theoretical scientists to the most important problems of industry. Another objective is to expose graduate students, and young engineers and scientists in general, to this fascinating field. The following major topics were covered by the conference: interface mechanics and multiphase systems; the theory of turbulence and its applications; transport phenomena and chemical reacting systems; the physicochemical hydrodynamics of low Reynolds number flow and the hydrodynamics of biological systems and polymers; and electrochemistry. There are 21 full-length papers, 102 contributed papers, and a summary by Professor Levich. Thirteen papers in scope have been entered into EDB and ERA. (LTN)

56220 (DOE/ER/13008—2) Prediction of multicomponent liquid-mixture viscosity from binary thermodynamic data. Wei, I.C.; Rowley, R.L. (Rice Univ., Houston, TX (USA). Dept. of Chemical Engineering). 1983. Contract AS05-82ER13008. 17p. (CONF-831111—1). NTIS, PC A02/MF A01. Order Number DE83011934.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

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A local composition model for multicomponent, nonaqueous, liquid mixture shear viscosity has been developed and tested. Only binary equilibrium thermodynamic information is required in addition to pure component data; no mixture viscosity data and no adjustable parameters are used. Predictions have been compared to experimental data obtained from the literature and in this laboratory yielding an average absolute percent deviation of 1.1% for ln(eta v) for 47 bianry systems consisting of 391 points over the entire composition range and 0.75% for seven ternary systems consisting of 63 data points.

56221 (EGG-SAAM—6398) Method of operator splitting or fractional steps and its applications to fluid-dynamic modelling. Berry, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1983. Contract AC07-76ID01570. 31p. NTIS, PC A02/MF A01. Order Number DE84000800.

The basic method of operator splitting or the fractional step method is explained in tutorial fashion. Simple applications are given to illustrate the versatility of the method. The applications are representations of the type of terms which could be encountered in complicated fluid-dynamic problems, notably, the equations of chemically reacting flow or multiphase flow. While these methods are applicable to current modelling efforts on current generation SISD (single instruction stream, single data stream) computers,

they appear to have a potentially greater application on vector SIMD (single instruction stream, multiple instruction stream) computers and parallel processor MIMD (multiple instruction stream, multiple data stream) computers.

56222 (NUREG/CP—0043, pp 295-317) **Hydrodynamic characteristics of two phase flow through porous media.** Dhir, V.K.; Chu, W.; Lee, H.; Catton, I. (Univ. of California, Los Angeles). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

In an attempt to understand the fluid flow and heat transfer characteristics of a degraded core, basic experimental investigations of two phase flow through porous layers formed of non-heated particles have been made. Two types of bed geometries have been studied. In the cylindrical test column, the effect of particle size, particle size distribution, and bed porosity on void fraction and pressure drop through the particulate bed has been investigated. The superficial velocities of liquid (water) are varied from 1.83 to 18.3 mm/s while the superficial velocities of gas (air) are varied from 0 to 68.4 mm/s. These superficial velocities are chosen so that pressure drop and void fraction measurement could be made for the porous layer in fixed and fluidized state. A model based on drift flux approach has been developed for the void fraction. Using the two phase friction pressure data, bounding values of the relative permeabilities of the gas phase have been determined. A few data for counter current flooding conditions have also been obtained.

56223 (NUREG/CP—0043, pp 353-383) **Behavior of water spray injected into air/steam environment.** Lee, S.Y.; Tankin, R.S. (Northwestern Univ., Evanston, IL). Apr 1983. NTIS, PC A99/MF A01 - GPO $13.00. (CONF-820962—).

From NRC/ANS meeting on basic thermal hydraulic mechanisms in LWR analysis; Bethesda, MD, USA (14 Sep 1982).

The behavior of a water spray injected into both an air and a steam environment was studied. The water spray is divided into two parts - sheet portion and droplet portion, and an analytical model is proposed for explaining the spray behavior. Experiments were performed to substantiate the analytical results. Holographic pictures were used to obtain in the droplet size distributions, which were used for computing the motion of spray droplets in the analytical model. For the sprays used in this study, much of the heat transfer occurs in the sheet portion, and the spray angle is primarily governed by the sheet portion. A correlation is obtained experimentally for breakup length in terms of the Weber number and the Jakob number.

56224 (SAND—83-1043C) **Finite-element analysis of incompressible laminar and turbulent flow with heat transfer.** Polansky, G.F.; Lamb, J.P.; Klein, D.E. (Texas Univ., Austin (USA); Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-830149—1). NTIS, PC A02/MF A01. Order Number DE84000042.

From 5. finite element methods in flow problems; Austin, TX, USA (23 Jan 1983).

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The finite-element method is investigated as a means of simulating incompressible, laminar, and turbulent flow past a confined backward facing step. Flow-field and heat-transfer results are compared with available experimental data and other computational results.

56225 (UCRL—89602) **Computer implementation, accuracy, and timing of radiation view-factor algorithms.** Shapiro, A.B. (Lawrence Livermore National Lab., CA (USA)). Jul 1983. Contract W-7405-ENG-48. 7p. (CONF-831111—8). NTIS, PC A02/MF A01. Order Number DE83017618.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

The three-dimensional finite element thermal analysis of enclosure radiation problems requires the calculation of the geometric surface to surface radiation view factors. The view factors can be calculated by either area or line integration algortihms. This paper addresses the implementation, accuracy and computational time involved in using these algorithms. Additionally, an algorithm to identify shadowing surfaces and methods to adjust the calculated view factors for increased accuracy are presented.

56226 **Hydrodynamic and heat transfer interactions in particle assemblages at intermediate Reynolds numbers.** Tal (Thau), R.; Lee, D.N.; Sirignano, W.A. (Carnegie-Mellon Univ., Pittsburgh, PA). *Annals of the New York Academy of Sciences;* **404**: 65-66(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

Hydrodynamic and heat transfer interactions in sphere assemblages at intermediate Reynolds numbers have been studied as part of a theoretical model of interactions between vaporizing fuel droplets. The wake effects have been estimated by considering two spheres in tandem. Since the wake effects of reducing the transport rates are significant even for large spacing between the spheres, the spherical cell models used in low Reynolds number hydrodynamics are inadequate for intermediate Reynolds numbers; therefore, cylindrical cell models are suggested. The Navier-Stokes and energy equations have been solved numerically within the representative cells for intermediate Reynolds numbers. Using a nonuniform mesh suited for the problem, several spheres are considered in tandem and the importance of wake effects in considerably reducing the drag and Nusselt number in the bulk is discussed.

56227 **Solid-loaded flows: applications in technology.** Molerus, O. (Universitaet Erlangen-Nuernberg, Germany). *Annals of the New York Academy of Sciences;* **404**: 111-125(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

The evaluation of experiments and the representation of the resulting data by nondimensional groups defined ad hoc largely governs the treatment of problems arising with solid-loaded flows in practice. Without doubt, this is a result of the very complex nature of solid-loaded flows and, consequently, empiricism tends to prevail, more or less. To overcome this situation, two sets of nondimensional groups, which take into consideration the translatory, as well as the rotary, motion of particles suspended in a fluid, are derived from the equations of motion of a solid body. The intuitive meaning of these nondimensional groups arises from their derivation. With respect to applications in engineering, the influence of the rotary motion of a particle on the motion of its center of gravity can thus be taken into account. As such, a common basis for the representation of the different phenomena observed with solid-loaded flows is established. The application of the above concepts to fluidization and hydraulic and pneumatic conveying proves their usefulness. New insights into well-known facts as well as new results demonstrate that taking the real nature of solid particles (i.e., those of finite dimensions) into consideration will provide a common and profound basis for the representation of different phenomena observed with solid-loaded flows in practice.

56228 **Analysis of annular two-phase, two-component flow in venturi scrubbers.** Gnyp, A.W.; St. Pierre, C.C.; Viswanathan, S. (Univ. of Windsor, Ontario). *Annals of the New York Academy of Sciences;* **404**: 127-129(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

Experiments have been performed on a Plexiglas pilot plant Venturi unit. Visual observations indicate that the annular two-phase, two-component flow creates a thin liquid layer that flows along the walls, together with a high-velocity gas stream carrying entrained liquid droplets in the core. A traversing probe was used to collect water samples from the core. The liquid film flowing on the walls was extracted through porous sintered metal plates located on two adjacent sides of the unit. Liquid core and film samples were acquired from one throat and two diffuser locations. Minimal variation of liquid flux in the direction perpendicular to liquid injection is reported. The experimental data are compared with behavior predicted by a two-dimensional transport model. (LEW)

4205 Materials Testing

REFER ALSO TO CITATION(S) 55745, 55767, 55784, 55977, 55978, 55979, 56095

56229 (CONF-830799—1) Development of ultrasonic methods for the nondestructive inspection of concrete. Claytor, T.N.; Ellingson, W.A. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE83017923.

From International ultrasonics conference; Halifax, Nova Scotia (12 Jul 1983).

Nondestructive inspection of Portland cement and refractory concrete is conducted to determine strength, thickness, presence of voids or foreign matter, presence of cracks, amount of degradation due to chemical attack, and other properties without the necessity of coring the structure (which is usually accomplished by destructively removing a sample). This paper reviews the state of the art of acoustic nondestructive testing methods for Portland cement and refractory concrete. Most nondestructive work on concrete has concentrated on measuring acoustic velocity by through transmission methods. Development of a reliable pitch-catch or pulse-echo system would provide a method of measuring thickness with access from only one side of the concrete.

56230 (EGG-M—04883) Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimens. Reuter, W.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 13p. (CONF-830805—60). NTIS, PC A02. Order Number DE84000895.

From 7. international conference on structural mechanics in reactor technology; Chicago, IL, USA (22 Aug 1983).

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This paper presents comparisons between predicted values of failure stress, from surface-flawed specimens, and experimental values. The comparison is made at test temperatures corresponding to the lower shelf and the lower transition region which correspond generally to elastic and elastic-plastic conditions, respectively. Failure is identified as the conditions for initiation of crack growth. Calculations of predicted values of stress for initiation of crack growth were made for 6.4 and 12.7 mm thick surface-flawed specimens. These calculations were based on using either the ASME Boiler and Pressure Vessel Code approach or that of Newman-Raju for calculating the front and back face correction terms. The results showed the ratio of the two stresses to range from 0.8 to 1.4 which indicates that neither approach is consistently more conservative. A comparison between experimentally-determined stresses and predicted stresses showed substantial differences between the Code approach and that of Newman-Raju. The ratio of experimentally-determined stresses to predicted stresses ranged from 0.78 to 1.55 and from 0.85 to 1.18 for the Code approach and that of Newman-Raju, respectively. The amount of conservatism appears to be nominally a function of cF^2, a term that has been found to quantify the severity of surface flaws. Therefore, it is recommended that the Newman-Raju approach for calculating the stress intensity for surface flaws be used instead of that suggested in the Code.

56231 (GKSS—83/E/17) Inspection of reactor fuel- and absorber-elements by means of neutron radiography with a small size antimony-beryllium neutron source. Greim, L.; Spalthoff, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 7p. GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.).

Also published in Neutron Radiography, J.P. Barton and P. van der Hardt (eds.), ECSC, EEC, EAEC, Brussels and Luxembourg (1983) p. 453-459.

For applications of neutron radiography in hot cells a small size Antimony-Beryllium neutron source has been designed and constructed. It has cylindrical shape with a diameter and a length of about 20 cm. The measured thermal neutron flux is $1.1x10^6$ n/cm^2 s per kCi ^{124}Sb. The results of an inspection of a spent BWR absorber element are shown. The neutron radiographs done with the Dysprosium transfer method revealed defects in the absorber tubes and loss of absorber material. The track etch foil imaging technique was used at the examination of a fuel element dummy of the ship NS Otto Hahn as test for a method for the detection of defective fuel pins.

56232 (IS-M—441) Effects of a finite aperture on the Inverse Born Approximation. Kogan, V.G.; Rose, J.H. (Ames Lab., IA (USA)). 1983. Contract W-7405-ENG-82. 18p. (CONF-830811—13). NTIS, PC A02/MF A01. Order Number DE83018086.

From Conference on quantitative NDE; Santa Cruz, CA, USA (7 Aug 1983).

One of the most important effects of complex part geometry is that the available entrance and exit angles for ultrasound are limited. We will present a study of the Inverse Born approximation in which we have data for incident (and exit) directions confined to a conical aperture. Modeling the direct problem by the Born Approximation, we obtained analytical results for (1) a weak spherical inclusion, and (2) a penny shaped crack (modeled by an oblate spheroid). General results are: (a) the value of the characteristic function γ is constant in the interior of the flaw, but reduced in value; (b) the discontinuity at the boundary of the flaw occurs over the lighted portion of the flaw; (c) this discontinuity is contrasted by a region where γ is negative; and (d) new non-physical discontinuities and non-analyticities appear in the reconstructed characteristic function. These general features also appear in numerical calculations which use as input strong scattering data from a spherical void and a flat penny shaped crack in Titanium. The numerical results can be straightforwardly interpreted in terms of the analytical calculation mentioned above, indicating that they will be useful in the study of realistic flaws. We conclude by discussing the stabilization of the aperture limited inversion problem and the removal of non-physical features in the reconstruction.

56233 (IS-M—448) Absolute determination of stress in textured materials. Thompson, R.B.; Smith, J.F.; Lee, S.S. (Ames Lab., IA (USA)). 1983. Contract W-7405-ENG-82. 16p. (CONF-830811—15). NTIS, PC A02/MF A01. Order Number DE83018083.

From Conference on quantitative NDE; Santa Cruz, CA, USA (7 Aug 1983).

The continuum theory of elastic wave propagation in deformed, anisotropic solids is reviewed with emphasis on those features which might be used to distinguish between stress induced changes in ultrasonic velocity and change due to material anisotropy, such as would be produced by preferred grain orientation in a polycrystalline metal. As noted by previous authors, one such feature is the difference in velocity of two shear waves, whose directions of propagation and polarization have been interchanged. In particular, when these directions fall along the symmetry axes of a rolled plate (assuming orthorhombic symmetry) and these are also the directions of principal stress, then the theory predicts that $rho(V_{12}^2-V_{21}^2) = T_1-T_2$ where rho is the density, V/sub ij/ is the velocity of a shear wave propagating along the i-axis and polarized along the j-axis, and T/sub i/ is a principal stress component. In addition to being independent of the degree of texture, this relationship has the advantage that no microstructurally dependent acoustoelastic coefficient is involved. The applicability of this prediction of continuum theory to heterogeneous engineering materials such as metal polycrystals is discussed using previously reported stress dependencies of ultrasonic velocities, and new experiments to answer some remaining questions are described. A possible configuration for using the effect to measure the value of a uniform stress in a plate of unknown texture is proposed.

56234 (IS-M—460) Computational tool for the design of ultrasonic systems. Wormley, S.J.; Thompson, D.O.; Lakin, K.M. (Ames Lab., IA (USA)). 1983. Contract W-7405-ENG-82. 7p. (CONF-830811—14). NTIS, PC A02/MF A01. Order Number DE83018092.

From Conference on quantitative NDE; Santa Cruz, CA, USA (7 Aug 1983).

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Advances in elastic wave scattering and inversion techniques have shown that advances in transducer technology are needed in order to fully exploit them. This is particularly true in the case of flaw sizing algorithms in which it has been demonstrated that a need exists for transducers with specified bandwidth characteristics. As a part of an effort to develop a composite, multiviewing ultrasonic transducer for flaw characterization, a computational tool has been developed which provides a convenient way to select driver pulse shapes and transducer characteristics which optimize this property. This computational tool is discussed. (WHK)

56235 (SAND—83-1372C) Alternative shock characterizations for consistent shock-test specification. Baca, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 38p. (CONF-8310166—1). NTIS, PC A03/MF A01. Order Number DE84000482.

From 54. shock and vibration symposium; Pasadena, CA, USA (18 Oct 1983).

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Mechanical shock environments must be characterized in the most complete manner possible if they are to be successfully simulated in the shock test laboratory. The objective of the research described in this paper is to evaluate three methods of analyzing transient acceleration time histories which represent promising alternatives to shock-response spectra as the basis for deriving consistent shock-test specifications. A shock-test specification is defined to be consistent if it meaningfully relates the operational and laboratory shock environments. The limitations of shock spectra are discussed in this regard before presenting the advantages of the new alternative characterizations. These shock analysis techniques include: (1) ranked peaks in the acceleration time history; (2) root-mean-square acceleration as a function of time; and (3) root-mean-square acceleration as a function of frequency. These shock characterizations provide the parameters necessary to develop a new shock test specification technique which can replace the current practice of enveloping shock spectra. Data from a simulated field shock environment are analyzed using all three shock characterizations as well as shock spectra. The new method of shock test specification is demonstrated using drop table and decaying sinusoid shock test inputs. Test specifications using the standard method of shock spectrum enveloping are also derived. The resulting shock test specifications are compared and the implications of using alternative shock characterizations in deriving consistent test specifications are identified. Beneficial aspects of utilizing these alternative shock analysis techniques instead of shock spectra are presented with particular emphasis being placed on the evaluation of conservatism associated with different shock test specification techniques.

4206 Safety Engineering

56236 (INIS-mf—8527) Annual Safety Report 1981. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 1982. 22p. (In Dutch). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703489.

A safety report from Section K (Nuclear Physics) of the Dutch National Institute for Nuclear and High Energy Physics is presented for 1981. The report begins with general matters concerning safety policy at NIKHEF, licences and expenditure. Work accidents (none of them radiological) are detailed and accident prevention considered. The measurement programme for neutron radiation in the vicinity of the accelerator is described and the results are discussed. The means and results of personnel dosimetry are also presented. The report is concluded with a list of publications concerning safety aspects at NIKHEF. (C.F.).

4207 Vacuum Engineering

REFER ALSO TO CITATION(S) 55785

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 55598, 56290

56237 (N—8324552) Design considerations for large space electric power systems. Renz, D.D.; Finke, R.C.; Stevens, N.J.; Triner, J.E.; Hansen, I.G. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Apr 1983. 23p. (NASA-TM—83064; E—1535). NTIS, PC A02/MF A01.

As power levels of spacecraft rise to the 50 to 100 kW range, it becomes apparent that low voltage (28 V) dc power distribution and management systems will not operate efficiently at these higher power levels. The concept of transforming a solar array voltage at 150 V dc into a 1000 V ac distribution system operating at 20 kHz is examined. The transformation is accomplished with series-resonant inverter by using a rotary transformer to isolate the solar array from the spacecraft. The power can then be distributed in any desired method such as three phase delta to delta. The distribution voltage can be easily transformed to any desired load voltage and operating frequency. The reasons for the voltage limitations on the solar array due to plasma interactions and the many advantages of a high voltage, high frequency at distribution system are discussed.

56238 (SAND—82-1425) Superregenerative amplifier in linear mode as a radar range gate - derivations. Williams, C.S. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1983. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01. Order Number DE84000978.

This paper presents the derivation of a formula for the output voltage of a superregenerative amplifier in linear mode when used as a radar range gate. Since the formula is applicable to transients, it can be used to find the gate response to radar-echo pulses at ranges different from the range of maximum gate response. Since radar echo as well as noise and jamming are often random processes, the paper also presents formulas for the mean-square output when the input is a stationary or transient random process.

56239 (UCRL—89613) Numerical modeling techniques for antennas. Miller, E.K. (Lawrence Livermore National Lab., CA (USA)). 19 Jul 1983. Contract W-7405-ENG-48. 30p. (CONF-8310167—1). NTIS, PC A03/MF A01. Order Number DE83015451.

From NATO-AGARD lecture series number 131; Ankara, Turkey (19 Oct 1983).

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An overview of wire-antenna computer modeling is given for infinite media and half-space type problems. The formulation and numerical solution methods are summarized, and applications are demonstrated with numerous examples.

4210 Combustion Systems

56240 (CONF-8210168—, pp 221-244) Industrial energy outlook: the role of coal. Farbstein, S.B. (B.F. Goodrich Co., Cleveland, OH). 1982. NTIS, PC A13/MF A01.

From 10. annual Illinois energy conference; Chicago, IL, USA (13 Oct 1982).

Forecasts of a rapid increase in industrial use of coal must be balanced with the combination of economic, regulatory, and institutional barriers that will slow that development. Only boiler-fuel use is likely to increase, although coal can be gasified for some process applications. New technologies for boiler conversion and new boiler designs include fluidized-bed combustion using fixed-bed or circulating boiler systems. B.F. Goodrich is working with Illinois energy planners to develop these technologies and to stimulate new coal use. 22 references, 3 figures, 8 tables. (DCK)

56241 **(DOE/MC/14129—1473) 20-Atmosphere rig PFBC test results. Test II. Investigations into the effect of coal-size distribution.** (National Coal Board, Leatherhead (UK). Coal Utilization Research Lab.). Aug 1983. Contract AC21-80MC14129. 49p. NTIS, PC A03/MF A01. Order Number DE84000214.

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A series of tests is being carried out in a 1ft x 1ft pressurized fluidized-bed combustor. This report presents results obtained in Test 11 when the combustor was operated at 10 and 16 atm, 3 and 4-1/2 ft/s fluidizing velocity and 1560°F bed temperature. The feedstock was comprised of Pittsburgh No. 8 coal and Plum Run dolomite. The main objective was to measure the performance when operating with two different coal size distributions - 1/8 inch x 1/16 inch and 1/16 inch x 0. Data on combustion efficiency, sulphur retention, NO/sub x/ emissions, alkali distributions and heat transfer are presented.

56242 **(DOE/PC/30214—T6) Heat transfer to tubes in freeboard space of fluidized-bed combustors. Progress report, February 1, 1983-August 1, 1983.** Chen, J.C.; Tuzla, K. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Mechanical Engineering and Mechanics). Aug 1983. Contract FG22-80PC30214. 11p. NTIS, PC A02/MF A01. Order Number DE84000846.

The objective of the research reported is to carry out an experimental study of heat transfer characteristics for tubes located in the freeboard region of fluidized beds. The main effort reported was given to evaluation of the dynamic contact data and phenomenological model developments. Heat transfer data were obtained on a horizontal tube in freeboard region. The feasibility of using capacitance probes for measurements of dynamic contact of bed particles with the tube surface was successfully established. High temperature heat transfer experiments have been completed for silica sand and limestone at temperatures of 300 to 750°C and gas velocities up to 5 m/s. Dynamic parameters required for calculating heat transfer are being computed from capacitance probe data, and development of a phenomenological model and a correlation for the heat transfer process for horizontal tubes in freeboard region are in progress. (LEW)

56243 **(DOE/PC/50261—T3) Investigate the effectivness of calcium-treated coals in the capture of sulfur gases generated in staged fired combustors. Third quarterly technical progress report, May 1-July 31, 1983.** Porter, J.H.; Manning, M.P.; Benedek, K.R.; Sharma, P.K. (Energy and Environmental Engineering, Inc., Cambridge, MA (USA)). 1 Sep 1983. Contract AC22-82PC50261. 25p. NTIS MF A01. Order Number DE83017042.

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In this quarter's work, a new procedure was developed to add calcium to pulverized coal. The method has been found to increase the calcium content of bituminous coal to 12% calcium by weight, which corresponds to a Ca/S ratio of greater than 2. Progress was also made on the combustion test facility this quarter. A new modification of the low-flow coal feeder has made that system steady and reliable. With the furnace wired and plumbed, and the other subsystems complete, the facility is almost ready to burn the treated coals.

56244 **(N—8323351) An investigation of equilibrium concepts. Final Report.** Prozan, R.J. (Continuum, Inc., Huntsville, AL (USA)). Oct 1982. 23p. (NASA-CR—170732). NTIS, PC A02/MF A01.

A different approach to modeling of the thermochemistry of rocket engine combustion phenomena is presented. The methodology described is based on the hypothesis of a new variational principle applicable to compressible fluid mechanics. This hypothesis is extended to treat the thermochemical behavior of a reacting (equilibrium) gas in an open system.

56245 **(N—8323545) Aerodynamic-wave break-up of liquid sheets in swirling airflows and combustor modules.** Ingebo, R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. 16p. (CONF-830635—2; NASA-TM—83353; E—1610). NTIS, PC A02/MF A01.

From 19. AIAA-SAE-ASME joint propulsion conference; Seattle, WA, USA (27 Jun 1983).

Experimental mean drop diameter data were obtained for the atomization of liquid sheets injected axially downstream in high velocity swirling and nonswirling airflow. Conventional simplex pressure atomizing fuel nozzles and splash type fuel injectors were studied under simulated combustor inlet airflow conditions. A general empirical expression relating recirprocal mean drop diameter to airstream mass velocity was obtained and is presented. The finest degree of atomization, i.e., the highest value of the coefficient C, was obtained with swirl can combustor modules (C 15) as compared with pressure atomizing nozzles (C 12).

56246 **(N—8324576) A critical review of pulsating combustion.** Goldman, Y.; Timnat, Y.M. (Technion-Israel Inst. of Tech., Haifa). Nov 1981. 20p. (TAE—468). NTIS, PC A02/MF A01.

In pulsating combustors a proper feedback between the flow and combustion processes results in periodic variations of the flow properties inside the combustor. The types of pulsating combustors and their applications are discussed.

56247 **(PB—83-200493) Solid fuel combustion chamber, progress report 1. Initial phase (until July 1982).** Schoeyer, H.F.R.; Korting, P.A.O.G. (Technische Hogeschool Delft (Netherlands). Dept. of Aerospace Engineering). Jun 1982. 25p. (LR—354). NTIS, PC E03/MF E01.

Solid fuel combustion chambers (SFCC) allow for the combustion of solid fuels at very high temperatures. Due to the high combustion temperatures (from 2000 to 3000 K), the thermal efficiency is high while also relatively clean combustion gases are produced. Toxic molecules like dioxines, PCB's etc. cannot exist at these high temperatures. The formation of nitrogen oxides may strongly be reduced by operating at stoichiometric conditions or just below stiochiometry. The present project therefore is aimed at determining experimentally the structure of the (combustion in the) boundary layer and the flow within the SFCC and the overall performance of the SFCC in relation to inlet conditions mass flow, oxygen/inert gas ratio, inlet pressure and inlet temperature.

56248 **(PB—83-200501) Solid fuel combustion chamber progress report 2. First phase, July-December 1982.** Schoeyer, H.F.R.; Korting, P.A.O.G.; Vos, J.B. (Technische Hogeschool Delft (Netherlands). Dept. of Aerospace Engineering). Dec 1982. 17p. (LR—363). NTIS, PC E03/MF E01.

In this report the first phase (July - December 1982) of the Solid Fuel Combustion Chamber project DLR 11.0120 is described. SFCC's have potential for energy conversion systems with very high efficiencies, clean combustors of waste and Solid Fuel Ramjets. There may be more applications. This is a report about the activities of the SFCC project group during the period July 1982 - December 1982. It presents a survey of the funding and expenses, lists the people involved in the project during this period, it describes the status of experimental and theoretical work, and describes the status of the development of experimental tools. Finally the users committee and a proposal for a parallel research project are briefly mentioned.

56249 **(PB—83-228437) Analytical models for industrial gas burner design. Part 1. Modeling methods. Topical report Apr 81-Jan 83.** Harsha, P.T.; Wang, T.S.; Sindir, M.M.; Edelman, R.B. (Science Applications, Inc., Chatsworth, CA (USA). Combustion Science and Advanced Technology Dept.). Jan 1983. 80p. (SAI—83-046-CH). NTIS, PC A05/MF A01.

The development and use of quantitative techniques in industrial gas burner design is described. These techniques make use of an array of fluid-dynamic and chemical-kinetic approaches, com-

bined in such a way as to provide optimum analytical tools for different aspects of industrial burner design. An example is provided in which aerodynamic analyses are used to define a combustor model. This combustor model, incorporating detailed methane chemical kinetics, provides design data on the performance of an industrial gas burner. Emphasis is on the prediction of the emissions characteristics of the burner and on methods for controlling NOx emissions through combustion process modifications. Appendices provide descriptions of both the aerodynamic analysis to investigate the effects of design variation on the flowfield, and the combustor model used to obtain burner performance results.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 55405, 56228, 56243

56250 (CONF-8110292—, pp 16p, Paper 7) **Analysis of the particle size distribution with cascade impactors by foundry industry.** Holzapfel, C.; Sporenberg, F. 20 Oct 1981. (In German). NTIS (US Sales Only), PC A06/MF A01.

From Symposium on gas cleanup; Essen, F.R. Germany (20 Oct 1981).

The particle size distribution analysis of the fluidized dust, inside the gas purification system of a cast iron melting induction furnace, is conducted using a cascade impactor. Obtained results indicate that the degree of separation is not a function of particle size. It is shown that the results of the analysis of the particle size with impactors by industrial plants are not invariant in relation to changes of experimental conditions. The probes taken in parallel with two different designed impactors are also not in agreement with each other. It could be also not possible to determine the particle size distribution of flue dust by the application of scanning electron microscopy and also by sedimentation.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 55843, 56653, 56699

56251 **(DOE/ER/10739—1) Proceedings of the sixth conference on the application of accelerators in research and industry.** Duggan, J.L.; Morgan, I.L. (eds.). (North Texas State Univ., Denton (USA); Scientific Measurement Systems, Inc., Austin, TX (USA); Oak Ridge National Lab., TN (USA)). Apr 1981. 965p. (CONF-801111—). NTIS, PC A99/MF A01. Order Number DE83017105.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

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Topics covered at the conference include: atomic and molecular physics; nuclear physics; CTR and related phenomena; trace analysis with ion beams and microprobes; accelerator technology, detectors, spectrometers; accelerator targets; neutron activation and bulk analysis; mineral exploration and geophysics; computed tomography; ion implantation; biological and chemical applications; radiation processing; metallurgical application in ion implantation, ion beam analysis, material modification; and medical applications in radiotherapy, image applications, radioisotope production. The proceedings contains 228 papers. Separate abstracts were prepared for the data base. (GHT)

56252 **(LA—9823-MS) High-Q ferrite-tuned cavity.** Earley, L.M.; Thiessen, H.A.; Carlini, R.D.; Potter, J.M. (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 5p. NTIS, PC A02/MF A01. Order Number DE84000128.

Rapid-cycling proton synchrotrons, such as the proposed LAMPF II accelerator, require approximately 10 MV per turn rf with 17% tuning range near 50 MHz. The traditional approach to ferrite-tuned cavities uses a ferrite which is longitudinally biased (rf magnetic field parallel to bias field). This method leads to unacceptably high losses in the ferrite. At Los Alamos, we are developing a cavity with transverse bias (rf magnetic field perpendicular to the bias field) that makes use of the tensor permeability of the ferrite. Initial tests of a small (10-cm-diam) quarter-wave singly re-entrant cavity tuned by several different ferrites indicate that the losses in the ferrite can be made negligible compared with the losses due to the surface resistivity of the copper cavity.

56253 **(LBL—16483) New concepts in particle acceleration.** Sessler, A.M. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 12p. (CONF-830822—23). NTIS, PC A02/MF A01. Order Number DE83017747.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

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Accelerator concepts discussed include the wake-field accelerator, the two-beam accelerator, the inverse free electron laser, and the laser plasma wave accelerator. (GHT). 18 references, 12 figures.

4302 Beam Dynamics, Field Calculations, And Ion Optics

56254 **(AD-A—127786/2) Research progress and forecast report for MSNW FEL oscillator program. Annual report 15 Jun 81-14 Aug 82.** Slater, J.; Quimby, D.C.; Grossman, W. (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). Jan 1983. 63p. NTIS, PC A04/MF A01.

The purpose of this program is to provide assessment data for determining the potential of tapered-wiggler free-electron laser (FEL) oscillators. It is expected that the tapered-wiggler concept will lead to the development of high-efficiency FELs by providing substantial energy extraction in a single pass of the e-beam through the wiggler magnet. The work consists of parallel theory and experimental tasks. The latter involve parameterization of the FEL interaction on a single pass basis, and this portion of the work has not yet been completed. The theory work described here deals with the transverse mode structure of FEL oscillators. This mode analysis has shown that (1) the one-way nature of the FEL gain media results in an asymmetric mode which is not an eigenmode of the cavity, i.e., it is described as a linear combination of cavity modes, (2) the higher-order mode content is largest in confocal or concentric cavities, rather than the intermediate cases, (3) the higher-order mode content can be controlled by aperturing, and (4) the quality of the output beam is nearly diffraction limited.

56255 **(CONF-830822—27) Measured response of TEV-I beam cooling electrodes.** Kramer, S.L.; Simpson, J.; Suddeth, D.; Goldberg, D.; Lambertson, G.; Voelker, F. (Argonne National Lab., IL (USA); Lawrence Berkeley Lab., CA (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE84000589.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

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Conventional wire techniques, in which a signal-carrying-wire simulates a particle beam, cannot be used to accurately measure the signal response of multi-element beam-cooling pickup arrays. On the other hand, such measurements are essential to confidently design and construct the stochastic cooling systems employed by the TEV-I antiproton source. Wire techniques suffer at least two deficiencies. One is the serious question of how well the fields excited and supported by a signal carrying wire in a pickup correspond to those produced by beams. The second arises from the fact that a large fraction of the wire signal power is coupled to each pickup element. The signal transmitted downstream is also diminished at each coupling with the result that little remains after a few elements. Two new measuring techniques have been developed and used to measure the response of 1 to 2 GHz arrays for TEV-I. Results of these measurements of a 16 strip-pair array are compared to predictions based upon wire measurements of single elements. These results will be used for the detailed design of the stochastic cooling systems.

56256 **Free electron laser injection oscillator.** Gover, A.; Gold, S.H.; Granatstein, V.L. US Patent Application 6-473,411. [nd]. Filed date 9 Mar 1983. 32p.

A free electron laser for use with a short-pulse relativistic electron source. The device includes a resonant optical cavity in which a spatially-periodic magnetic field is produced by a wiggler magnet assembly. An input optical beam having a wavelength lying within the gain bandwidth of the free electron laser interaction is injected into the cavity. A beam of relativistic electron produced by a short-pulse source, such as an RF-linac, is injected into the cavity. The electron beam and the input optical beam interact under the influence of the magnetic field to amplify the input optical beam.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 56099, 56595, 56649

56257 **(BNL—33607) Acceleration of heavy ions in the AGS and CBA.** Barton, M.Q. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 3p. (CONF-830822—24). NTIS, PC A02/MF A01. Order Number DE83017762.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

A plan has been developed to inject ion beams from the Brookhaven Tandem or a cyclotron added to the Tandem into the AGS. This beam could then be injected into a relativistic heavy ion collider. The availability of many CBA components adds to the attractiveness of this proposal.

56258 **(BNL—33609) Colliding-beam-accelerator lattice.** Claus, J.; Cornacchia, M.; Courant, E.D.; Parzen, G. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 7p. (CONF-830822—25). NTIS, PC A02/MF A01. Order Number DE83017875.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

We describe the lattice of the Colliding Beam Accelerator, a 400 x 400 GeV pp facility proposed for construction at Brookhaven National Laboratory. The structure adopted is very versatile, in part in consequence of its desirable behavior as function of momentum deviation and as function of the betatron tunes. Each of the six insertions can be arranged to meet specific requirements at the crossing points as illustrated by a discussion of the tuneable low-beta insertions. The luminosity in these low-beta insertions (2×10^{33} cm^{-2} sec^{-1}) would be an order of magnitude larger than the standard insertions.

56259 **(CAPE—2875) SLAC SPEAR layouts (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 8 Sep 1983. Contract AC03-76SF00515. USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830.

80 35-mm aperture cards.

The drawings listed on the Auxiliary Drawing List provide the general overall layout of the SLAC SPEAR electron-positron storage ring. The individual drawings as listed on the auxiliary drawing list delineate the layouts of the area, system, or parts of the storage ring. Construction details are generally not included on these drawings. Other drawing packages must be consulted for the details of construction, fabrication, and specifications.

56260 **(CONF-8309127—2) Fabrication of self-supported oxide targets by cationic adsorption in cellulosic membranes and thermal decomposition.** Quinby, T.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84000719.

From International Nuclear Target Society workshop; Argonne, IL, USA (7 Sep 1983).

Techniques for producing relatively durable oxide films of various elements will be described. Areal densities of films produced to date have ranged from 150 $\mu g/cm^2$ to 2.5 mg/cm^2, and are virtually transparent. Films produced by this technique were weighed directly and mounted on frames. General parameters for use of this technique will be described.

56261 **(DOE/ER/02289—T4) Systematic study of the R211 trigger counters.** Miller, D.H. (Northwestern Univ., Evanston, IL (USA)). [nd]. Contract AC02-76ER02289. 15p. NTIS MF A01. Order Number DE83017855.

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The strong variation in pulse heights over the area of the R211 trigger counters was first noted by C. Leroy and J.P. Matheys (Logbook 4; p. 60) after the anomalous results of the preliminary 31/31 GeV analysis. With these variations it is clear that the lower pulse heights associated with events in the lower stacks could lead to inefficiencies dependent on threshold and high voltage settings. The obvious questions are: (a) What are the magnitudes of the losses required to explain the observed effects; (b) Is there any objective evidence that good events were in fact lost in the 31/31 GeV run due to low pulse heights; (c) Are the magnitudes of these losses compatible with those which might lead to the observed anomalies; (d) Is it possible to make reasonable corrections for any such losses. This report is a brief summary of efforts to investigate these issues over the past month.

56262 **(DOE/ER/10698—3) Cryogenic polarized-target facility. Progress report, July 1, 1982-June 30, 1983.** Gould, C.R.; Haase, D.G. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). 1983. Contract AS05-80ER10698. 20p. NTIS, PC A02/MF A01. Order Number DE84000833.

The goal of this four-year research project is to build a cryogenically polarized target facility for measuring total neutron cross sections of polarized neutrons incident on polarized nuclei. The target consists of a helium dilution refrigerator and a 70-KG superconducting magnet. The dilution refrigerator has been successfully operated both with and without the superconducting magnet during this contract period. A dummy copper sample was cooled to 9.5 mK with the magnet off, and a 1.8 cm thick aluminum target was cooled to 11.3 mK with the magnet on. This latter temperature corresponds to a target polarization of 36%. Preliminary experiments with longitudinally polarized 14-MeV neutrons have been performed. Asymmetries in the total cross sections for positive and negative helicity states are typically less than 0.3%. The accuracy is presently limited by systematic errors associated with beam instabilities. Effort over the coming year will be directed towards reducing systematic errors in experiments with aluminum and niobium targets, using both longitudinal and transverse polarized neutrons.

56263 (INIS-mf—8474, pp 177-189) **Future U.S. accelerators.** Bingham, H.H. (California Univ., Berkeley (USA). Dept. of Physics). 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

Design concepts and parameters, present status and probable future of the Isabelle, Tevatron I and II and SLAC Linear Collider projects are discussed. Some other proposed accelerator projects, and some ideas for future accelerators are outlined.

56264 (INIS-mf—8479, pp vp) **I.4 Irradiation sources for GAA.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

Radionuclide sources (^{60}Co, ^{124}Sb, ^{232}Th and its daughter products) are used for gamma activation analysis; mainly used however, is bremsstrahlung produced by electron accelerators of which are listed linear accelerators, and cyclic accelerators (betatron, microtron, electron synchrotron). (H.S.).

56265 (INIS-mf—8479, pp vp) **II.2 Betatron IGAA.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

A 21 MeV betatron and a 43 MeV betatron were used as radiation sources for routine IGAA of minerals. The gamma lines are given of radioisotopes used for IGAA and the specifications of the 21 MeV betatron are presented. The use of long and short-lived radioisotopes was experimentally tested. In the use of long-lived radioisotopes irradiation time was usually 3 to 6 hrs, cooling time

more than 2 hrs. Experimentally determined sensitivity is given for Mg, Ti, Mn, Ni, Cu, Zn, Ga, Ge, As, Sr, Zr, Nb, Mo, Ag, Cd, Ce, Nd, Sm, Eu, Gd, Ta, Tl, Pb. IGAA using long-lived radioisotopes was applied for the determination of the chemical composition of heavy mineral concentrates. Short-lived radioisotopes were used for determining the sensitivity for C, N, O, F, Mg, Si, Cl, K, Ti, Cr, Fe, Cu, Zn, Ga, Se, Br, Rb, Sr, Zr, Mo, Ag, Cd, Sn, Ba, Pr, Nd, Hg. Use of the betatron for IGAA is considerably limited, namely for its low electron flux density. (J.P.).

56266 (INIS-mf—8479, pp vp) **II.3 Microtron IGAA.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

The results are presented of microtron gamma activation analysis of various types of mineral materials. Tables show the nuclear characteristics of the most important products of photonuclear reactions. Graphically represented are the gamma spectra of standards and samples activated by bremsstrahlung, detected by a semiconductor Ge(Li) detector and a NaI(Tl) well-type detector. The measured samples contained sulfides (pyrite, galena, sphalerite, molybdenite, antimonite, chalcopyrite, berzelianite), oxides (quartz, corundum, cassiterite, rutile), salts (fluorite, apatite, limestone, magnesite), silicates (zircon, pyrope, beryl, tourmaline, lepidolite, kaolin), rocks, tektites, meteorites (basalt, granite, peridotite, greisen, meteorite, moldavite), ocean bed samples (Mn-Fe nodules, deep-sea clay) and other materials such as manganese ore, humus, heavy minerals, lignite, mushrooms. Also presented are experimental data obtained from the application of short-term microtron IGAA. (J.B.).

56267 **(LBL—16505) Control and operation cost optimization of the HISS cryogenic system.** Porter, J.; Bieser, F.; Anderson, D. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 12p. (CONF-830841—20). NTIS, PC A02/MF A01. Order Number DE83017741.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

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The Heavy Ion Spectrometer System (HISS) relies upon superconducting coils of cryostable design to provide a maximum particle bending field of 3 tesla. A previous paper describes the cryogenic facility including helium refrigeration and gas management. This paper discusses a control strategy which has allowed full time unattended operation, along with significant nitrogen and power cost reductions. Reduction of liquid nitrogen consumption has been accomplished by making use of the sensible heat available in the cold exhaust gas. Measured nitrogen throughput agrees with calculations for sensible heat utilization of zero to 70%. Calculated consumption saving over this range is 40 liters per hour for conductive losses to the supports only. The measured throughput differential for the total system is higher.

56268 **Improved method for producing negative ion beams from the group IIA elements for tandem Van de Graaff applications.** Alton, G.D.; Benjamin, J.A. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 1, 1-5(1 Jun 1983).

A brief description of a method for producing relatively intense molecular negative ion beams for the difficult Group IIA elements is given which offers considerable improvement in terms of source operation and beam intensity stability over other methods conventionally utilized. It is particularly suited for use in cesium plasma sources such as the Aarhus geometry and axial geometry versions of the source. The method utilizes H_2 source feed gas for the production of a hydrogen-rich plasma discharge which sputters a negatively biased probe made of elemental or copper alloy material. Negative ion beams of $MgH_3^- >= 12$ μ A have been realized during routine operation of the 25 MV tandem accelerator. Negative ion beam intensity data, typical source operational parameters, and examples of mass spectra associated with their production are given. Interesting intermetallic molecular negative ion beams consisting of the particular Group IIA element and a Cu alloy atom have also been observed.

56269 **Brookhaven: stopping muons.** *CERN Courier;* **23**: No. 4, 128-129(May 1983).

Published in summary form only.

4304 Storage Rings

56270 **(BNL—33652) High-level control programs at NSLS.** Bozoki, E.S. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 5p. (CONF-8309144—1). NTIS, PC A02/MF A01. Order Number DE83010935.

From EPS conference on computing in accelerator design and operation; Berlin, F.R. Germany (20 Sep 1983).

The mathematical model of an accelerator can be used to control its operation and also to simulate its behavior. Through the use of such modeling programs it is possible to control a few important machine parameters rather than the many individual magnets. Such programs have been implemented for the current generation of accelerators. At the NSLS, two control program systems have been developed; TRANCO for the transport lines and RING for the accelerator/storage rings. These systems are modular, can be used independently or in conjunction with each other, can communicate with each other via sequential and random access data files and has a common data base.

56271 **(CONF-830910—1) Standard format for data files.** Tischler, J.Z. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84000345.

From 3. national conference on synchrotron radiation instrumentation; Upton, NY, USA (12 Sep 1983).

A proposal is made for a standard file format to be used at US synchrotron sources. This standard format encompasses all data structures likely to be needed, and will improve transferability of analysis programs. The proposed data format is a limited implementation of ISO/DP8211-Specification of a Data Descriptive File for Information Interchange.

44 INSTRUMENTATION

56272 **(PTB-Me—35) Survey of the possibilities to maintain correct measurements through increased reliability of components or through "operational fault perceptibility".** Volkmann, C.U. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Mechanik). Dec 1982. 33p. (CONF-8109229—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751049.

From OIML-seminar on electronic devices incorporated in weighing, liquid and gas volume measuring instruments; Boras, Sweden (21 Sep 1981).

Tests and requirements for the pattern approval of mechanical weighing machines are based on long-term experience and detailed regulations, whereas equivalent treatment of electronic devices of weighing machines is a new kind of task. In this field experience is still scarce, and regulations are lacking. While there is some unanimity that the sensitivity of electronic devices to any kind of electromagnetic interferences has to be judged on the grounds of some tests, there is no universally accepted guideline as to how to assure, over a few weeks of pattern approval tests, the measuring stability for a period of years. Two major concepts are being followed to this end: increased reliability of components and "operational fault perceptibility (OFP)". After some remarks concerning the terminology to be used, both concepts are discussed and eventually compared.

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 55356, 55742, 55773, 56261, 56266, 56326, 56339, 56340

56273 **(BNL—33622) MPS II: a tracking detector system for large high-rate experiments.** Platner, E.D. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 7p. (CONF-830798—2). NTIS, PC A02/MF A01. Order Number DE83017913.

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

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The MPS II tracking detector system was developed for a variety of low-cross-section experiments that are only practical in a high-beam-rate environment. It was built as a general-purpose device for use in a fixed-target (AGS) situation where the beam passes through all elements of the detector. The electronics is dead-timeless so that high efficiency is achieved at event rates as high as 10^6/sec/ch. This capability would allow these detectors to be used as close as 20 cm from a hadron-hadron collider at 1 Tev of luminosity up to 10^{33}/cm^2/sec.

56274 **(DESY—83-014) Large polygon drift chamber for the JADE experiment at PETRA.** Clarke, D.; Hedgecock, C.R.; Marshall, R.; Dietrich, G.; Steffen, P.; Wietbrock, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1983. 5p. (CONF-830223—10). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83751028.

From Wire chamber conference; Vienna, Austria (15 Feb 1983).

Presented by G. Dietrich at the Wire Chamber Conference, Vienna (Austria) 1983.

A large cylindrical shell drift chamber is described. The chamber is 2.4 m long and 1.75 m diameter with a shell thickness of 45 mm. The sense wires are strung in the form of a polygon over rigid supports. This allows a measurement of the z-coordinate in the direction of the cylinder axis with an accuracy of approximately 250 μ. Results of tests on a representative prototype are presented.

56275 (INIS-mf—8474, pp 29-38) **Report on water Cerenkov proton decay detectors.** Reines, F. (California Univ., Irvine (USA). Dept. of Physics). 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The unified gauge theories of elementary particle interactions, like SU(5) based theory, predict finite lifetime and decay of proton. Recent experiments going on are discussed and compared. Three experiments using the detection of Cherenkov radiation propagating in water are described in details. The basic concepts, parameters and present status of detectors are presented. These projects and the expected results are on the boundaries of performance of recent experimental techniques. The problems of separating neutrino background and of comparing results with theoretical SU(5) predictions are discussed.

56276 (INIS-mf—8575, pp 459) **Intensifying screens in X-ray diffraction photography.** Lindqvist, K. Sep 1982. NTIS (US Sales Only), PC A20/MF A01. (CONF-820956—Absts.).

From 13. general meeting of the International Mineralogical Association; Varna, Bulgaria (19 Sep 1982).

Published in summary form only.

56277 **(Juel-Spez—162) Electrets for measurement of background radiation dose and radon concentration in air.** Soman, S.D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung fuer Chemische Analyse). Jul 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751051.

This survey includes preparation, handling, charge reading and application of electrets for background radiation dose as well as radon concentration measurement in air.

56278 **(LA—9764-M) User's guide to the multiple-independent detector system.** Seeger, P.A. (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01. Order Number DE84000122.

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The multiplexing scheme used at the Weapons Neutron Research Facility for arrays of individual detectors is presented. Information is given to allow a user to configure an instrument, to connect and test modules, to monitor operation, and to diagnose faults.

56279 **(LBL—16017) Evaluation of Hamamatsu R1635 photomultiplier.** Lo, C.C.; Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 6p. NTIS, PC A02/MF A01. Order Number DE84001252.

Characteristics have been measured of the Hamamatsu R1635 10 mm-diameter photomultiplier. Some typical photomultiplier characteristics - such as gain, dark current, transit and rise times - are compared with data provided by the manufacturer. Photomultiplier characteristics, generally not available from the manufacturer, such as the single photoelectron and pulse response time spread for full photocathode illumination were measured and are discussed.

56280 **(LBL—16248) Evaluation of the Beijing Instrument Factory GDB-44F photomultiplier.** Young, E.; Lo, C.C. (Lawrence Berkeley Lab., CA (USA)). 15 Dec 1982. Contract AC03-76SF00098. 21p. NTIS, PC A02/MF A01. Order Number DE84000849.

Characteristics have been measured for the GDB-44F 2"-diameter photomultiplier. Some typical photomultiplier characteristics - such as gain, dark current, anode output current, transit and rise times as a function of voltage between anode and cathode, and photoelectron pulse-height spectrum, the quantum-efficiency and the single-electron transit time spread were measured. Descriptions of the measuring systems were also given.

56281 **(MPI-PAE/Exp.El.—111) System of large multiwire proportional chambers for a high intensity experiment.** De Palma, M.; Favuzzi, C.; Maggi, G.; Ranieri, A.; Selvaggi, G.; Spinelli, P.; Gebauer, H.J.; Fent, J.; Freund, P.; Seyboth, J. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). 1983. 17p. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen, Germany, F.R.

Submitted to Nucl. Instrum. Methods.

We describe a system of three multiwire proportional chambers used in the experiment NA24 at CERN. Each chamber consists of four wire planes (2x2 m^2 sensitive area), packed together in the same mechanical frame with only five cathode foils. All planes are electrically independent and can be operated individually although each of the three inner cathode foils is used for two adjacent wire planes. Another feature of the chamber is that an area around the beam can be desensitized to allow operation in a high intensity beam.

56282 **(MPI-PAE/Exp.El.—112) Parallel plate avalanche chamber as an endcap detector for time projection chamber.** Peisert, A. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). 1983. 20p. (CONF-830223—). Max-Planck-Institut fuer Physik und Astrophysik, Muenchen, Germany, F.R.

From Wire chamber conference; Vienna, Austria (15 Feb 1983).

We have investigated the possibility of using a parallel plate avalanche chamber as endcap detector for the time projection chamber instead of a multiwire proportional chamber. Such a solution has several advantages. The positive ions feedback in the drift volume and the E vectorxB vector distortions are considerably reduced; moreover, space charge effects in the detector are smaller allowing higher rates and probably higher gains without deterioration of the energy resolution. Detection of the fast electron signal component allows to obtain two-track separation in the drift direction of 1.5-2 mm; the localization in the two other directions can be

realized with accuracies better than 100 μm and with typical two-track separations between one and two mm. The detector is realized exclusively with grids and thick wires, thus eliminating breakdown problems.

56283 (N—8323573) A balloon-borne instrument for high-resolution astrophysical spectroscopy in the 20-8000 keV energy range. Paciesas, W.; Baker, R.; Bocklet, D. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1983. 52p. (NASA-TM—85011). NTIS, PC A04/MF A01.

The Low Energy Gamma ray Spectrometer (LEGS) is designed to perform fine energy resolution measurements of astrophysical sources. The instrument is configured for a particular balloon flight with either of two sets of high purity germanium detectors. In one configuration, the instrument uses an array of three coaxial detectors (effective volume equal to or approximately 230 cubic cm) inside an NaI (T1) shield and collimator (field of view equal to or approximately 16 deg FWHM) and operates in the 80 to 8000 keV energy range. In the other configuration, three planar detectors (effective area equal to or approximately square cm) surrounded by a combination of passive Fe and active NaI for shielding and collimation (field of view equal to or approximately 5 deg x 10 deg FWHM) are optimized for the 20 to 200 keV energy range. In a typical one day balloon flight, LEGS sensitivity limit (3 sigma) for narrow line features is less than or approximately .0008 ph/cm/s square (coaxial array: 80 to 2000 keV) and less than or approximately .0003 ph/square cm/s (planar array: 50 to 150 keV).

56284 (N—8324833) Calibration of the active radiation detector for Spacelab-One. (Alabama Univ., Huntsville (USA)). Dec 1982. 19p. (NASA-CR—170752). NTIS, PC A02/MF A01.

The flight models of the active radiation detector (ARD) for the ENV-01 environmental monitor were calibrated using gamma radiation. Measured sensitivities of the ion chambers were 6.1 + or - 0.3 micron rad per count for ARD S/N1, and 10.4 + or - 0.5 micron rad per count for ARD S/N2. Both were linear over the measured range 0.10 to 500 m/rad hour. The particle counters (proportional counters) were set to respond to approximately 85% of minimum ionizing particles of unit charge passing through them. These counters were also calibrated in the gamma field.

56285 (ORNL/TM—8720) User's manual for the FERDO and FERD unfolding codes. Rust, B.W.; Ingersoll, D.T.; Burrus, W.R. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 116p. NTIS, PC A06/MF A01. Order Number DE84000294.

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FERDO and FERD are unfolding codes which can be used to correct observed pulse-height distributions for the nonideal response of a pulse-height spectrometer or to solve poorly conditioned linear equations. It is assumed that the response of the spectrometer is given by Ax = b, where A is the spectrometer response function matrix, x is the unknown spectrum, and b is the pulse-height distribution. FERDO does not solve directly for x, but instead solves for p = Wx, where W is a window function matrix. Typically, W is the resolution function of an ideal spectrometer which has a single Gaussian response. The effective resolution of the unfolding solution may be varied by choice of W. Confidence intervals ($p^{\pm}$, p/sup up/) are found for each element of the solution p. FERDO and FERD are written in IBM 360/370 Fortran (Level H). This manual describes and derives the mathematical procedures used by the codes, tells how to write input data for them, and gives solutions to some sample problems to illustrate the output.

56286 (PNL—3982) Response characteristics of selected personnel neutron dosimeters. McDonald, J.C.; Fix, J.J.; Hadley, R.T.; Holbrook, K.L.; Yoder, R.C.; Roberson, P.L.; Endres, G.W.R.; Nichols, L.L.; Schwartz, R.B. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 69p. NTIS, PC A04/MF A01. Order Number DE84000852.

Performance characteristics of selected personnel neutron dosimeters in current use at Department of Energy (DOE) facilities were determined from their evaluation of neutron dose equivalent received after irradiations with specific neutron sources at either the National Bureau of Standards (NBS) or the Pacific Northwest Laboratory (PNL). The characteristics assessed included: lower detection level, energy response, precision and accuracy. It was found that when all of the laboratories employed a common set of calibrations, the overall accuracy was approximately +-20%, which is within uncertainty expected for these dosimeters. For doses above 80 mrem, the accuracy improved to better than 10% when a common calibration was used. Individual differences found in this study may reflect differences in calibration technique rather than differences in the dose rates of actual calibration standards. Second, at dose rates above 100 mrem, the precision for the best participants was generally below +-10% which is also within expected limits for these types of dosimeters. The poorest results had a standard deviation of about +-25%. At the lowest doses, which were sometimes below the lower detection limit, the precision often approached or exceeded +-100%. Third, the lower level of detection for free field ^{252}Cf neutrons generally ranged between 20 and 50 mrem. Fourth, the energy dependence study provided a characterization of the response of the dosimeters to neutron energies far from the calibration energy. 11 references, 22 figures, 26 tables.

56287 (PNL-SA—11213-Rev.) Method to improve the evaluation of a combination track-etch dosimeter/spectrometer. Brackenbush, L.W.; Hadlock, D.E.; Parkhurst, M.A.; Faust, L.G. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 4p. (CONF-830969—1-Rev.). NTIS, PC A02/MF A01. Order Number DE84001005.

From 12. international conference on solid state nuclear track detectors; Acapulco, Mexico (4 Sep 1983).

Approximate neutron energy spectra can be obtained by using a combination of dosimeter elements which have a different response for different neutrons energies. This paper describes a simple mathematical technique which can be applied to combination neutron dosimeter/spectrometers to increase the accuracy of the dose equivalent evaluation. A simple iterative algorithm is applied to determine the dose equivalent from CR-39 (polydiallyldiglycol carbonate), polycarbonate, LR-115 (cellulose nitrate) track etch and albedo neutron detectors. The algorithm is simple enough to allow rapid evaluation of several different types of personnel neutron dosimeters with better accuracy than most existing methods.

56288 Radon measurement intercomparisons. Fisenne, I.M.; George, A.; McGahan, M. (Environmental Measurements Laboratory, New York, NY). *Health Physics;* 45: No. 2, 553-556(Aug 1983).

A workshop was held at the Environmental Measurements Laboratory (EML) in June 1980 for the purpose of informal discussions on the ongoing ^{222}Rn research and possible future directions in its study in the indoor environment. In March 1981, the Lawrence Berkeley Laboratory (LBL) hosted a second radon workshop with a view toward establishing an interlaboratory calibration network for radon and radon daughter measurements. A description of the EML radon calibration chamber and the results of the radon intercomparisons are presented. (KRM)

56289 Counting anticoincidences to reduce statistical uncertainty in the calibration of a multiplicity detector. Peelle, R.W.; Spencer, R.R. (Oak Ridge National Lab., TN (USA). Engineering Physics Div.). *Nuclear Instruments and Methods in Physics Research;* 211: No. 1, 167-170(1 Jun 1983).

The observation of anticoincidences reduced statistical uncertainties as well as pileup corrections in the efficiency calibration of a multiplicity detector. The efficiency of the 4π gadolinium-loaded organic scintillation detector was measured for detecting capture of neutrons scattered by the hydrogen in a second detector. In such situations the effect of background upon the counting fluctuations is reduced below the value that would occur if the average counting rate during coincidence gates were utilized. The applicable formulae were obtained by elementary methods and were verified with experimental data and with computer simulations for a broad range of detector efficiencies and background intensities. The general requirements for use of the technique are indicated.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

56290 (SAND—83-1045C) ESD evaluation of radiation-hardened, high-reliability CMOS and MNOS ICs. Soden, J.M.; Stewart, H.D.; Pastorek, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 13p. (CONF-8309162—1). NTIS, PC A02/MF A01. Order Number DE84000138.

From 5. annual EOS/ESD symposium; Las Vegas, NV, USA (27 Sep 1983).

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Standard human-body-equivalent circuit electrostatic discharge (ESD) tests were performed on the inputs of high-reliability, radiation-hardened integrated circuits (ICs) designed with seven different technologies. Metal and silicon gate complementary MOS (CMOS) and metal-nitride-oxide-semiconductor (MNOS) ICs with design rules ranging from 10 microns down to 2 microns were evaluated. The ESD hardness of these ICs ranged from 1 kV to greater than 9 kV. The low-range ESD hardness ICs were fabricated with a masking polysilicon ring that defined the input protection diodes. Tests on commercial equivalent ICs demonstrated that the ESD hardness of the radiation-hardened ICs was not significantly less than the ESD hardness of the commercial equivalent ICs. The failure modes and mechanisms of the ICs were evaluated. Most of the ICs that did not have the masking polysilicon ring failed because of input to V/sub DD/ or V/sub SS/ shorts due to degraded protection diodes. ESD tests with the pulse applied between the package metal lid and the package pins were also performed. These lid tests produced permanent input damage, the same as occurred during tests with the pulse applied to the package input, but the damage occurred at lower voltages. ESD pulses with peak voltages as low as 250 volts produced arcs from the lid to the input bond wires, resulting in degraded inputs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 55533, 55773, 56129, 56193

56291 (CAPE—2874) SLAC wire wrap (WW) board (BD) prototypes Fastbus Controller (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). 27 Apr 1983. Contract AC03-76SF00515. USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830.

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The drawings listed on the drawing list provide the data and specifications for constructing a prototype SLAC Fastbus Controller. This device is an interface between a microprocessor and the Fastbus Crate. The Fastbus Controller is essentially a plug in socket for one of a variety of micro-processors in the Fastbus Crate. The Fastbus is a new NIM standard Crate system. This unit is a wire wrap version which is the forerunner of the yet to be built printed circuit version.

56292 (LBL—16247) Evaluation of the Beijing Instrument Factory GDB-52LD photomultiplier . Young, E.; Lo, C.C. (Lawrence Berkeley Lab., CA (USA)). Dec 1982. Contract AC03-76SF00098. 22p. NTIS, PC A02/MF A01. Order Number DE84001010.

Characteristics have been measured for the GDB-52LD 2"-diameter photomultiplier. Some typical photomultiplier characteristics – such as gain, dark current, anode output current, transit and rise times as a function of voltage between anode and cathode, and photoelectron pulse-height spectrum, the quantu-efficiency, and the single-electron transit time spread were measured. Descriptions of the measuring systems were also given.

56293 (NP—3770372, pp 1-16) Sub-project A1: Interferometry. Schwarz, G.; Einsfeld, K.; Knauss, H.; Schmidt, W. 1982. (In German). NTIS (US Sales Only), PC A99/MF A01.

In SFB 85 - progress report for the years 1980/81/82.

In the sub-project "Interferometry", efforts have been made to develop a contact-free method for high-precision measurements of general density fields. The main fields of interest are problems related to the flow around fully three-dimensional bodies and flow problems in connection with cascades. Hardware and software problems had to be solved to improve the method of interferometry and to obtain a comfortable and quantitative measuring method.

56294 (SAND—83-2084C) Automated thermal conductivity probe, and applications to powders. Drotning, W.D. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 17p. (CONF-8310163—2). NTIS, PC A02/MF A01. Order Number DE84000451.

From 18. international thermal conductivity conference; Rapid City, SD, USA (3 Oct 1983).

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A thermal conductivity probe has been developed for measurements of powders and porous media from ambient temperature to 1300 K in vacuum or an inert gas atmosphere. Automated data acquisition and graphical analysis programs have been developed in FORTRAN for use with a laboratory mini-computer. Nonlinear data analysis techniques are available which can account for the thermal probe response due to contact resistance and probe thermal mass effects. Programs have also been developed with thermal BASIC for use with a small, portable desktop computer system. Examples of the use of the probe and data acquisition and analysis system are shown for measurement of the effective thermal conductivity of ceramic and metal powders.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 55479

56295 Operation and life of the Zetatron neutron tube in a borehole logging application. Shope, L.A.; Berg, R.S.; O'Neal, M.L.; Barnaby, B.E. (Sandia National Labs., Albuquerque, NM (USA)). *International Journal of Applied Radiation and Isotopes;* **34**: No. 1, 269-272(Jan 1983).

The physical assembly and electrical characteristics of a Zetatron neutron tube are described. This tube is small (38 mm diameter by 126 mm), sealed-off, pulsed deuterium-tritium (D-T) accelerator. Peak output rates up to 8×10^{11} neutrons/s (6×10^{8} neutrons/pulse) are typical. Mean time to failure in a borehole logging application was 152 h for the bare tube and 91 h for the tube-transformer assembly. Shelf life appears to be at least 2 yr.

45 EXPLOSIONS AND EXPLOSIVES

REFER ALSO TO CITATION(S) 55996

4501 Chemical

REFER ALSO TO CITATION(S) 56128, 56156

56296 (UCRL—15550) Dynamic fracture experiments on VRA propellant. Murri, W.J.; Horie, Y.; Curran, D.R. (Stanford Research Inst., Menlo Park, CA (USA)). Jun 1977. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01. Order Number DE84000168.

Objective was to begin developing a fracture and fragmentation model for VRA propellant. Nine plate-impact experiments were conducted. No damage was observed for impact stresses up to 1.4 kbar. At an impact stress of 1.58 kbar, the recovered specimen was fragmented, and at 6.3 kbar, the propellant burned. Several large fragments from the 3.5 kbar test were sectioned, and cracks were observed. The propellant appears to fracture and fragment by cracking and debonding of the HMX grains, followed by propagation of intergranular cracks in the matrix material. The size distribution of the HMX grains was measured. The cumulative distribution is nearly linear in a semi-log plot. The fragment size distribution was measured for the 3.5 kbar test. The fragment size distribution has a similar shape to that for the HMX grains. A viscoelastic-viscoplastic stress-strain relation was developed for applying the computational fracture models to the VRA propellant. The viscoelastic

portion of this model is consistent with available Hopkinson bar data. Uniaxial strain relations were derived.

56297 **(UCRL—15551) Fracture model for high-energy propellant. Annual report.** Murri, W.J. (SRI International, Menlo Park, CA (USA)). Nov 1980. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01. Order Number DE84000169.

A dynamic equation of state (eos) for VRA propellant was developed based on data from particle velocity gage experiments and ultrasonic data from LLL. Included in the eos is a model for the propellant fracture that was developed earlier. We improved the fracture model by including a stress relaxation process that allows the cracks to open gradually as they are subjected to tensile stresses. We also changed the model to allow only one active fracture plane per computational cell, thereby improving numerical convergence. With the dynamic equation of state and the improved fracture model, we achieved good agreement with the experiments. We also simulated KIPS test 50 performed at Lawrence Livermore Laboratory. Reasonable agreement was obtained between calculation and experiment. We estimated that the ratio of new surface area to volume was about 600 cm^2/cm^3. Our calculations show that the initial compression is followed by a tensile stress wave of sufficient magnitude to completely fracture the propellant. The tensile wave is subsequently followed by a recompression wave of about 1 kbar that lasts for several tens of μs. Such conditions are ideal for initiating a deflagration-to-detonation transition (DDT).

56298 **(UCRL—15552) Fracture model for high-energy propellant. Annual report.** Murri, W.J.; Seaman, L. (SRI International, Menlo Park, CA (USA)). Dec 1981. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01. Order Number DE84000170.

During the past year, we have successfully added a computational model of shock-initiation-of-detonation that supplements our previously-developed fracture model for high-energy propellants. The resultant combined model allows computational simulations to be performed of cases where mechanically-produced fractures contribute to the initiation of detonation. In the model, when the stress is compressive, the initiation routine is operative; when the stress is tensile, the fracture routine is operative. The initiation routine contains a chemical reaction rate that is sensitive to the amount of fracture damage produced in the material, and therefore leads to enhanced reaction in previously fractured material during recompression. These two routines were tested by computationally simulating a proposed one-dimensional impact experiment in which a propellant is fractured and then recompressed. The results of this calculation indicated a reaction beginning in the damaged material at the time when the recompression started. As the recompression continues, the calculation predicts a rapid increase in pressure signifying a detonation. The model thus successfully describes fracture-enhanced reaction in a reasonable manner. We have also conducted preliminary studies of how to model the influence of gas from chemical reactions occurring during compression on crack growth and fragmentation.

56299 **One-dimensional dense-fluid detonation wave structure.** Abdelazeem, M.S. (Univ. of California, Davis); Hoover, W.G. *Journal of Physical Chemistry;* 87: No. 15, 2795-2798(21 Jul 1983). Contract W-7405-ENG-48.

Ree provided an accurate representation of the thermodynamic properties of the Lennard-Jones fluid. This equation of state is used to calculate the Chapman-Jouguet state and the wave structure of steady-state plane dense-fluid detonation. The basic detonation equations are set up for a dense fluid in which a single irreversible bimolecular reaction $2A \rightarrow B + C$ takes place with the release of chemical energy. The reactants and products are described by the same equation of state. The Enskog theory is used to provide the transport coefficients and to calculate the collision rate. 6 figures.

4502 Nuclear

56300 **(N—8324796) Calculation of wing response to gusts and blast waves with vortex lift effect.** Chao, D.C.; Lan, C.E. (Kansas Univ. Center for Research, Inc., Lawrence (USA)). Apr 1983. 67p. (NASA-CR—170340). NTIS, PC A04/MF A01.

A numerical study of the response of aircraft wings to atmospheric gusts and to nuclear explosions when flying at subsonic speeds is presented. The method is based upon unsteady quasi-vortex lattice method, unsteady suction analogy and Pade approximant. The calculated results, showing vortex lag effect, yield reasonable agreement with experimental data for incremental lift on wings in gust penetration and due to nuclear blast waves.

4503 Explosion Detection

REFER ALSO TO CITATION(S) 56527

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

56301 **(BNL—28287) Joint pdf of a scalar and its gradient.** Meyers, R.E.; O'Brien, E.E. (Brookhaven National Lab., Upton, NY (USA)). Aug 1980. Contract AC02-76CH00016. 26p. NTIS, PC A03/MF A01. Order Number DE84000913.

A closed-model equation is derived which describes the evolution of the single-point jont probability density function of a scalar and its gradient in a turbulent advection field. To obtain a closed form a relaxation model is assumed for molecular diffusion and a white-noise Kubo approximation for the advection. With this model, the role of chemistry and turbulent advection are examined for their effects on inducing statistical dependence between the scalar and its gradient. It is shown that such dependence is less significant in a homogeneous turbulence as the Reynolds number increases. It is also demonstrated that an n/sup th/ order single species reaction (n not equal to 0,1) tends to produce stronger dependence between the scalar and its gradient when the former is small and the latter large.

56302 **(CONF-820888—2) Representativeness of meteorological observations.** Nappo, C.J. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.). Feb 1983. Contract AI05-76EV03688. 17p. NTIS, PC A02/MF A01. Order Number DE83017699.

From Methods for comparing precipitation chemistry data workshop; Rensselaerville, NY, USA (10 Aug 1982).

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The representativeness of meteorological observations is becoming a subject of increasing concern in all branches of the atmospheric sciences. For example, in research, an understanding of representativeness is required to evaluate a large assortment of meteorological models and assess how well meteorological instruments sample atmospheric phenomena. In applications, representativeness affects interpretations of weather forecasts as functions of scale, site selection for wind and solar energy systems, and the designs of buildings and structures. It also is important in the regulation of air quality. To address the subject of representativeness formally, the AMS Committee on Atmospheric Measurements sponsored a workshop, which was held in Boulder, Colorado, in early summer, 1981. The workshop panel consisted of experts in the fields of atmospheric measurements, atmospheric turbulence and diffusion, numerical modeling, air quality assesment, air quality regulations, and forest management. Their task was to formulate a meaningful definition of representativeness, suggest possible ways of assessing it, and present some scientific examples. A summary report of this workshop has been published in the AMS bulletin,; however, this presentation discusses and expands upon the workshop results, using more details and examples than appear in the summary.

56303 **(CONF-8308117—1) Comparison of frequency determination using real sodar data.** Coulter, R.L.; Martin, T.J.; Underwood, K.H. (Argonne National Lab., IL (USA); Florida State Univ., Tallahassee (USA)). 1983. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01. Order Number DE83017942.

From 2. international symposium on acoustic remote sensing of the atmosphere and ocean; Rome, Italy (29 Aug 1983).

The development of frequency analysis of sodar signals has progressed from early tracking-filter estimates of the frequency of the strongest signal as a function of time, and hence height, to the full frequency spectrum at each range gate presented in real time. In general, the calculated wind velocities are a function of the way in which the time series representing the information within the range gate is treated. Although the differences resulting from alternate techniques usually are not large, they can be significant for specialized applications and might lead to different theoretical interpretations of the turbulent velocity field. This paper investigates and compares several techniques for velocity (or frequency) estimation using two approaches. Relative differences are explored with actual experimental data obtained under convective conditions. Absolute differences are explored using an artificial signal imbedded in atmospheric noise. 3 references, 5 figures.

56304 **(CONF-8308117—2) Surface heat flux derived from sodar amplitude and frequency data: a comparison.** Coulter, R.L.; Wesely, M.L.; Underwood, K.H.; Martin, T.J. (Argonne National Lab., IL (USA); Florida State Univ., Tallahassee (USA)). 1983. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE83017930.

From 2. international symposium on acoustic remote sensing of the atmosphere and ocean; Rome, Italy (29 Aug 1983).

The structure of the atmospheric boundary layer is known to undergo large diurnal variations that are critically important in processes such as the diffusion and dispersion of pollutants, development of convection and rainfall, and the air-surface exchange of momentum, moisture, and trace substances. Estimates of the flux of energy from the earth's surface to the atmosphere clearly are important for the operation of models attempting to predict the daily development of the planetary boundary layer (PBL). Measurements of surface heat flux in simple terrain can be made relatively easily using eddy-correlation techniques to measure the correlation of vertical velocity w and temperature T at a point within the surface layer. However, in complicated terrain or for estimates above the surface layer, a volume or area average is a potentially more useful estimate since the uncertainties introduced by inhomogeneities and statistical variability are reduced. The surface heat flux has been estimated previously from the temperature structure parameter C/sub T/^{2} and from estimates of the variance of vertical velocity σ/sub w/. This paper compares these techniques with eddy correlation point estimates made under convective conditions in the VOICE (Vertical Observations Involving Convective Exchange) experiment near Champaign, Illinois, USA, in cooperation with the Dry Deposition Intercomparison Experiment (DDIE), which supplied complete measurements of surface layer parameters including winds, temperatures, humidities, sensible heat flux H/sub c/, and latent sensible heat flux L/sub w/E. 6 references, 5 figures, 1 table.

56305 **(DP—1667) April 23; 1983 tornado at the Savannah River Plant.** Garrett, A.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1983. Contract AC09-76SR00001. 20p. NTIS, PC A02/MF A01. Order Number DE84000559.

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Just before 8:00 p.m. on Saturday, April 23, 1983, a small (F1) tornado touched ground in Jackson, South Carolina and traveled northeast for several miles, passing just northwest of the SRP 700-A Area. The tornado uprooted or snapped many large trees in Jackson, and damaged several homes and buildings, including the loss of an entire roof from one store. After it passed through Jackson, the tornado damaged pine forests on the SRP border. Based on the Fujita tornado intensity scale and observed damage, the maximum winds in the tornado were probably 100 to 150 mph. Several swaths in the forested area, each several hundred yards long, were almost denuded (80 to 90% uprooting or snapping of trees). As the tornado approached A Area, it appeared to be weakening, with maximum tree losses of 30 to 50%. The A-Area meteorological tower measured winds of 62 mph before the wind sensor was blown off the tower. Damage to A Area was small, although several trailers lost windows and pieces of roofing, one trailer was overturned, and at least one small shed was demolished. The tornado continued to the northeast where it died out over the SRP forest after felling trees for several more miles. Inspection of the rest of the SRP site from a helicopter showed that no other tornados hit SRP during the April 23 storm, although other tornados hit parts of South Carolina and Georgia. It was the first known occurrence of a tornado at SRP since 1976.

56306 **Spectroscopic detection of acetylene and ethane in the Earth's atmosphere, through ground-based infrared solar observations.** Zander, R. (Universite de Liege, Belgium); Stokes, G.; Brault, J. *C.R. Acad. Sc. Paris;* **295**: 583-586(11 Oct 1982). (In French).

The analysis of infrared solar spectra recorded between 8 and 13 μm at the Kitt Peak National Observatory, Tucson, Arizona (U.S.A.), has allowed us to determine, for the first time by spectroscopic means, the column densities of acetylene and of ethane present in the earth's atmosphere. The mean volume mixing ratios above the site of observation, deduced for these two hydrocarbons, are respectively (2.7 +/- 0.6) x 10^{-11} and (1.2 +/- 0.2) x 10^{-9}.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 55400, 55423, 55454, 55539, 55830, 55831, 55832, 56131, 56139, 56250, 56475

56307 **(ANL/EES-TM—225) Energy and Environmental Systems Division, 1983 research review.** (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 27p. NTIS, PC A03/MF A01. Order Number DE84000902.

Selected research highlights from 1982 are briefly described. Studies were conducted in the areas of fossil energy systems, renewable resource systems, financial aspects of electric utilities, industrial technology, transportation, and international energy development. (ACR)

56308 **(BNL—32839) Discussions of SCADER presentations.** Schwartz, S.E.; Daum, P.H.; Lee, Y.N. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 17p. (CONF-821136—25). NTIS, PC A02/MF A01. Order Number DE83011354.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

This report consists of the formal discussion of three papers presented at the 4th International Conference on Precipitation Scavenging, Dry Deposition and Resuspension at Santa Monica, CA, November 29-December 3, 1982. The papers and authors are as follows: Cloudwater Acidity Measurements and Formation Mechanisms - Experimental Design, Stephen E. Schwartz, Peter H. Daum, Mark R. Hjelmfelt and Leonard Newman; Studies of the Gas and Aqueous Phase Composition of Stratiform Clouds, Peter H. Daum, Stephen E. Schwartz and Leonard Newman; and Kinetics of Odixation of Aqueous Sulfur(IV) by Nitrogen Dioxide, Yin-Nan Lee and Stephen E. Schwartz. The discussion consists of prepared reviewers' comments, comments and questions from the floor, and responses of the presenting authors.

56309 **(CONF-8309150—1) Oxygen-18 measurements in the assessment of natural and anthropogenic sulfur in the environment.** Holt, B.D.; Kumar, R. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01. Order Number DE84000566.

From International workshop on stable isotopes in the assessment of natural and anthropogenic sulfur in the environment; Pushchino, USSR (9 Sep 1983).

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Oxygen isotope ratio measurements are uniquely applicable to the study of mechanisms of formation of natural or man-made sulfates found in the environment. Some of the mechanisms of for-

mation of SO_4^{2-} from SO_2 are aqueous-phase air oxidation, aqueous-phase H_2O_2 oxidation, and high-temperature oxidation to SO_3 before hydrolysis to H_2SO_4 in combustion sources. Once formed, the sulfates are extremely stable with respect to isotopic exchange with water with which they may be subsequently associated. As SO_2 is gradually converted to sulfate in a given air mass, the fraction of primary sulfate in the mixture necessarily decreases. Thus, if the sulfate content in the primary fraction at a given receptor site is relative low, the sulfates are likely to be the result of transport from distant sources. On the other hand, a relatively high fraction of primary sulfates would indicate that most of the relevant emission sources are within the region of the receptor site. Measurements of $\delta^{18}O$ of sulfates and associated waters can be applied to the study of bacterial, chemical and physical processes which regulate the steady-state balance of the sulfur-oxygen system in the oceans. Similarly applications of $\delta^{18}O$ measurements can be made to determine whether the sulfates in certain ground waters originate from solution of evaporite sulfates or from aqueous air oxidation of sulfides. Such information is important to geological subsurface mapping.

56310 (LBL—16525) **Dependence of indoor-pollutant concentrations on sources, ventilation rates, and other removal factors.** Nero, A.V. Jr.; Grimsrud, D.T. (Lawrence Berkeley Lab., CA (USA)). 2 Aug 1983. Contract AC03-76SF00098. 36p. NTIS, PC A03/MF A01. Order Number DE84001043.

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The behavior of several classes of chemical and physical pollutants include emissions from combustion appliances, radon and its progeny, formaldehyde, and other organic compounds. Current research at Lawrence Berkeley Laboratory is described and research needs in the area of indoor air quality is pointed out. (ACR)

56311 (LMF—102) **Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.** Snipes, M.B.; Marshall, T.C.; Martinez, B.S. (eds.). (Inhalation Toxicology Research Inst., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76EV01013. 589p. NTIS, PC A25/MF A01. Order Number DE83012610.

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Studies are presented of the effect on man of airborne particulates and gaseous emissions associated with the production of energy. Included in the report from the Inhalation Toxicology Research Institute are papers on: (1) the physical and chemical characterization of energy technology aerosols; (2) laboratory studies of aerosol generation and characterization; (3) in vitro predictors of toxicity; (4) disposition and fate of inhaled materials; (5) dose-response relationships for inhaled radionuclides; (6) dose-response relationships for inhaled chemical toxicants; (7) biological factors which influence dose-response relationships; and (8) risk assessment. (JMT)

56312 (LMF—102, pp 27-32) **Combustion source sampling with polymer adsorbents-artifacts from heating and exposure to NO_2.** Hanson, R.L.; Clark, C.R.; Carpenter, R.L.; Hobbs, C.H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The polymer adsorbents XAD-2 and Tenax-GC are frequently used to sample the organic vapors from combustion sources. The artifacts formed by heating XAD-2 and passing 87 ppM NO_2 through adsorbent samplers containing XAD-2 or Tenax-GC were characterized. The characterization involved extracting the adsorbents, testing the extracts in the Salmonella mutagenicity assay, and chemical analysis by gas chromatography and gas chromatography/mass spectrometry. The artifacts of XAD-2 formed by sampling NO_2 were mutagenic. Tenax-GC is a more suitable polymer adsorbent than XAD-2 for sampling combustion effluents because of its higher thermal stability and nonmutagenic artifacts from sampling NO_2.

56313 (LMF—102, pp 47-50) **Aerosol concentrator: design, construction, calibration and use.** Barr, E.B.; Hoover, M.D.; Yeh, H.C. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

An aerosol concentrator using the virtual impaction principle has been designed, fabricated and evaluated. Particles larger than a designed cut-off aerodynamic diameter were enriched in a bleed flow which was 5 to 40 percent of total flow, and up to 95 percent of vapors, gases or small particles in the original aerosol were extracted. The device has been used in conjunction with compressed air nebulizers to produce enriched aerosols of PuO_2, polystyrene and other particulates while removing excess water vapor or gases.

56314 (LMF—102, pp 51-54) **Electric charge of aerosol particles from a fluidized bed aerosol generator.** Carpenter, R.L.; Yeh, H.C.; Cheng, Y.S. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The fluidized bed aerosol generator (FBG) has proved to be a useful method of generating aerosols from dusts. Observations of particle deposition patterns in exposure systems and the effects of ^{85}Kr deionizers suggests that the aerosolized dust particles carry a large electric charge. We found that the average charge per particle was higher for insulators than for metals and increased with increasing airflow for most materials.

56315 (LMF—102, pp 59-63) **Aerosolization of coal gasifier-derived liquid condensates for inhalation exposures of laboratory animals.** Newton, G.J.; Wong, B.A.; Mitchell, C.E. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A system has been developed, tested and used to aerosolize an oil-like low Btu coal gas condensate for inhalation toxicology studies with laboratory animals. Ultrasonic homogenization in distilled water provided a stable emulsion which was subsequently aerosolized with an ultrasonic nebulizer. Aerosol mass concentrations greater than 50 μg/liter were achieved with a mass median aerodynamic diameter of 1.2 μm. For inhalation exposure of Fischer-344 rats, carbon-14-labeled benzo(a)pyrene and tritium-labeled 2-aminoanthracene were mixed with the coal gas condensate prior to aerosolization.

56316 (LMF—102, pp 79-83) **Equilibrium bipolar charge distribution on nonuniform primary straight chain aggregate aerosols.** Yeh, H.C.; Cheng, Y.S. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Based on a theory previously developed for a linear chain aggregate of uniform spheres, a general theory describing the equilibrium bipolar charge distribution for straight chain aggregate aerosols consisting of primary spheres of different diameters was developed. The present theory can be stated as: the equilibrium bipolar charge distribution of straight chain aggregate aerosols with nonuniform primary spheres can be expressed by Boltzmann's Law with an equivalent diameter (d/sub eL/) such that: d/sub eL/ = / sup n/Σ/sub i=1/ d/sub i/, where n is the number of primary particles in the aggregates and d/sub i/ is the diameter of the primary particles.

56317 (LMF—102, pp 84-87) **Parallel flow, screen-type diffusion battery.** Yeh, H.C.; Cheng, Y.S.; Kanapilly, G.M. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Characterization of dynamic aerosols such as formed by combustion or explosion is difficult when conventional diffusion batteries are used because of fluctuations in aerosol concentration. Based on the screen-type diffusion battery theory, a seven-cell, parallel flow, screen-type diffusion battery (PFDB) was designed, constructed and tested for size characterization and size classification of ultrafine aerosols. Air flow to each cell was controlled by a critical orifice and the same aerosol was sampled simultaneously in each cell. The penetration in each cell was determined from mass or radioactivity content of each cell. The performance of the PFDB and

its use in the characterization of irregularly shaped and/or unstable aerosols are discussed.

56318 (LMF—102, pp 88-93) **Effects of aerosol loading on screen diffusion batteries.** Cheng, Y.S.; Evans, J.M.; Pole, R.A.; Yeh, H.C. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Screen diffusion batteries are used to determine the size distribution of submicron aerosols. Aerosols accumulated on the screen surface build up a dendrite structure which leads to restriction of flow and an increase of aerosol collection efficiencies. This report describes a study which shows how diesel exhaust aerosol loading influences the performance of diffusion batteries. The pressure drop across diffusion batteries, penetration of a test aerosol and microscopic structural change on the screens were measured at successively increasing loading. Our results showed a continuous degrading of performance in terms of size distribution obtained by screen diffusion batteries; this was accompanied by microscopic structural change of the screens and an increased pressure drop. Of three types of screens tested, these effects increased with increasing mesh number (i.e. SS635 > SS400 > SS200). Thus, SS200 and SS400 mesh screens appear more suitable as diffusion battery cell material to characterize high concentration aerosols.

56319 (LMF—102, pp 94-100) **Analysis of screen diffusion battery data.** Cheng, Y.S.; Yeh, H.C. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

This report describes a computer scheme using a modified Twomey's iterative inversion method to analyze screen diffusion battery data. Since the screen diffusion battery response function is double-valued, the image effect will cause errors in data reduction unless a truncated response function with upper size cut at the maximum penetrating size is used. To avoid image effect errors, an appropriate cyclone or impactor pre-cutter should be used in front of a screen diffusion battery when sampling aerosols of unknown size. Since particle detector efficiencies are size dependent, inclusion of these efficiency functions in data analyses gives better results of size distribution and total number concentration.

56320 (LMF—102, pp 373-378) **Aerosol monitoring and characterization during animal exposures to diesel exhaust generated with a simulated driving cycle.** Cheng, Y.S.; Yeh, H.C.; Mokler, B.V. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Monitoring and characterization of diesel exhaust aerosols in a chronic exposure system are reported. Diesel exhaust was generated from a 5.7 liter displacement General Motors diesel engine operated under the Federal Test Procedure (FTP) cycle simulating an urban driving pattern. Condensation nucleus counter measurements showed that aerosol concentrations followed variations of the FTP cycle. Simultaneous filter samples taken at four different positions of 2 m^3 Hazleton exposure chambers showed uniform aerosol distribution. Time-averaged concentrations monitored by filter samples over 1 year of exposure indicated levels within +-10 percent of the designed levels of 7000, 3500 and 350 $\mu g/m^3$. A combination of a Lovelace multijet (LMJ) cascade impactor followed by a parallel flow diffusion battery (PFDB) gave size distribution based on mass. Mass median diameters and geometric standard deviations of diesel particles were 0.23 μm (4.4), 0.25 μm (4.5) and 0.26 μm (4.2) for high-, medium- and low-level chambers, respectively. The impactor/PFDB combination offered a new technique for aerosol measurement covering aerosol size from submicron to micron size.

56321 (LMF—102, pp 475-477) **Selection of atmospheric dispersion models for use in risk assessments of entire technologies.** Seiler, F.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Criteria for the selection of atmospheric dispersion models in risk assessments of entire technologies are analyzed. The state of knowledge on the health effects of the agent involved strongly influences the evaluation, which focuses on averaging procedures, resolution in space-time and error on propagation. Uncertainties in the cause-effect relationship are the final contributions to the error of the result. Intermediate calculations should neither increase this error unduly nor be done with significantly better accuracy. In this context, methods of performing a credible calculation with an effort commensurate with the state of knowledge are discussed.

56322 (PB—83-204826) **Improved emission estimation techniques for computerized networks: a user's manual. Final report.** Herlihy, E.T.; Byun, J.H.; Horodniceanu, M.; Falcocchio, J.C. (Urbitran Associates, Inc., New York (USA)). Sep 1982. 25p. NTIS, PC A02/MF A01.

This report summarizes the software revisions and program set-ups for implementing an improved method to estimate transient operation VMT on UTPS highway networks. Utilizing existing framework of UTPS, this report provides a description of the software that permits the analyst to more accurately estimate and test the sensitivity of a revised application of emission rates to specific components of the typical vehicle trip. These include subroutine documentation and deck set-ups for UROAD, HNET, UMATRIX AND MOBILE1 computer runs required in the procedure. This application, as set up, provides for transient mode VMT calculations for all VMT that is within 505 seconds of the origin zone or trip start.

56323 (PB—83-228338) **Development of advanced residential cooktop burner with low NO/sub x/ emissions. Annual report Feb 82-Jan 83.** DeWerth, D.W.; Sterbik, W.G. (American Gas Association Labs., Cleveland, OH). 28 Feb 1983. 96p. NTIS, PC A05/MF A01.

This report describes the results of work conducted during February 1982 - January 1983. A literature search was initiated to identify the state-of-the-art of NOx ($NO + NO_2$) reduction technologies, including NOx measurement methodologies, air infiltration and ventilation trends, the impact of NOx (NO_2) emissions on health, and air quality standards. As a result of the literature search NOx (NO_2) reduction goals were established for the project and technologies to achieve these goals identified. This report also covers the development of a prototype burner which examined flue gas recirculation, burner designs, secondary air baffling and flame inserts as potential technologies to reduce NOx (NO_2). Because of their potential for NOx (NO_2) reduction shown by initial experiments, an in-depth analysis of ring insert configurations was conducted. These results, along with other technological experiments, are presented in this report.

56324 (UCRL—88649-Rev.2) **Atmospheric dispersion of ammonia: an ammonia fog model.** Kansa, E.J.; Ermak, D.L.; Chan, S.T.; Rodean, H.C. (Lawrence Livermore National Lab., CA (USA)). Jul 1983. Contract W-7405-ENG-48. 32p. (CONF-830702—7-Rev.2). NTIS, PC A03/MF A01. Order Number DE84000165.

From 21. ASME/AIChE national heat transfer conference; Seattle, WA, USA (24 Jul 1983).

Ammonia (NH_3), a by-product of many chemical processes, is widely used as a fertilizer and as a raw material for many chemical syntheses. The purpose of this paper is to discuss the atmospheric dispersion of ammonia resulting from a high pressure release. The resulting nature of the two-phase cloud of ammonia vapor and droplets has a significant effect on its dispersion characteristics. Our calculations of a 40 ton release show that even under moderately high wind conditions, the resulting ammonia cloud remains negatively buoyant for considerable distances downwind. 10 references, 15 figures.

56325 **Research project Me 657/1: Turbulent macrostructures in flows at large Re numbers.** Mercker. Berlin, Germany, F.R.; Technische University ([nd]). 34p. (In German).

The aim of the research project was to investigate atmospheric turbulences within the first 20 m above atmospheric surface boundary layers. Subject fields: a) Determination of the critical gradient Richardson number Ri resulting from the ratio of the loss of turbulent fluctuation energy of the work against buoyancy forces and the energy of turbulent fluctuation from the mean movement. b) Investigation of cause, interaction and dissipation of small-size and large size turbulent vortexes in boundary layers. The experi-

ments were carried out in free atmosphere. In order to be able to calculate the various parameters it was necessary to measure the temperature profile as well as the velocity profile of the first 20 m of atmospheric boundary layers at different times of the day by means of different anemometers.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 55537, 55539, 55549, 55550, 56277, 56288, 56310, 56347, 56349, 56369

56326 (LA—9658) Operational experience with two tritium-effluent monitoring systems. Haynie, J.S.; Gutierrez, J.A. (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE84000126.

The Los Alamos National Laboratory has designed, built, and operated two new tritium stack monitoring systems: the wide-range tritium effluent monitor, with a useful range of a few microcuries per cubic meter to 10^8 $\mu Ci/m^3$, and an improved Kanne chamber and new electrometer, called a Model 39 Electrometer-Chargemeter. Both tritium chambers reduce sensitivity to tritium contamination, assure a fast response, and convert easily to microcuries by an integrating chargemeter with digital readout. We discuss the calibration of these monitors and point out the advantages of these chambers over conventional systems. 3 references.

56327 (LMF—102, pp 55-58) Modification and evaluation of a Lovelace nebulizer. Cheng, Y.S.; Norgon, R.W.E. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The Lovelace nebulizer is a high specific output (μl/liter air), inexpensive aerosol generator especially suitable for producing radioactive aerosols. Some inconsistency in performance has been noted because of variation in the nebulizer geometry. This report describes an effort to modify a Lovelace nebulizer head in order to understand the problems and to better define the performance of the nebulizer. The aerosol outputs and droplet size distributions were measured as function of pressure drop, shape of screw baffle, orifice to liquid feed-tube separation and orifice to baffle separation.

56328 (LMF—102, pp 74-78) Emanation of ^{232}U daughter products from submicron particles of uranium oxide and thorium dioxide by nuclear recoil and inert gas diffusion. Coombs, M.A.; Cuddihy, R.G.; Diel, J.H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Emanation of ^{232}U daughter products by nuclear-recoil and inert gas diffusion from spherical particles of uranium oxide and thorium dioxide containing 1 percent ^{233}U and having physical diameters between 0.1 and 1 μm were studied. Thorium-228 ions recoiling from the particles and ^{220}Rn diffusing from the particles were collected and measured separately. The calculated ^{228}Th recoil range was 0.02 μm and the ^{220}Rn diffusion coefficient was 3 x 10^{-14} cm^2/s in uranium oxide and thorium dioxide particles. The release of ^{232}U daughter radionuclides from inhaled relatively insoluble particles by recoil and diffusion will significantly alter radiation doses received by critical tissues compared to the condition where radionuclide release occurs by particle dissolution only.

56329 (PNL—4670) Background information on sources of low-level radionuclide emissions to air. Corbit, C.D.; Herrington, W.N.; Higby, D.P.; Stout, L.A.; Corley, J.P. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 49p. NTIS, PC A03/MF A01. Order Number DE84001350.

This report provides a general description and reported emissions for eight low-level radioactive source categories, including facilties that are licensed by the Nuclear Regulatory Commission (NRC) and Agreement States, and non-Department of Energy (DOE) federal facilities. The eight categories of low-level radioactive source facilities covered by this report are: research and test reactors, accelerators, the radiopharmaceutical industry, source manufacturers, medical facilities, laboratories, naval shipyards, and low-level commercial waste disposal sites. Under each category five elements are addressed: a general description, a facility and process description, the emission control systems, a site description, and the radionuclides released to air (from routine operations).

56330 (UCRL—89189) Electrolytic gettering of tritium from air. Souers, P.C.; Tsugawa, R.T.; Stevens, C.G. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 18p. (CONF-831171—3). NTIS, PC A02/MF A01. Order Number DE84000174.

From American Vacuum Society meeting; Boston, MA, USA (1 Nov 1983).

We have removed 90% of 1 part-per-million tritium gas in air of 25% to 35% humidity by the dc electrical action of the solid proton electrolyte hydrogen uranyl phosphate (HUP). Gettering takes 5 to 24 hours for a 1 cm^2 HUP disc at 2 to 4 V in a static, 1200 cc gas volume. Hydrogen gas may be used to flush captured tritium through the HUP. Liquid water leaches out the tritium but water vapor is ineffective. This technique promises an alternative to the conventional catalyst/zeolite method.

56331 Indoor radiation exposures from ^{222}Rn and its daughters: a view of the issue. Nero, A.V. (Lawrence Berkeley Lab., CA). *Health Physics;* 45: No. 2, 277-288(Aug 1983).

Exposure to ^{222}Rn daughters indoors can result in significant risk to the general public, particularly those living in homes with much higher than average concentrations. This paper reviews what is known about indoor concentrations, associated risks and the effect of measures to save energy by reducing ventilation rates, using US housing as an example. It concludes that, by employing appropriate control measures in homes having unacceptably high concentrations, the average exposure (and therefore risk) of the general public can remain at its present level, or even decrease, despite programs to save energy by tightening homes.

56332 Airborne radionuclides and radiation in buildings: a review. Nero, A.V. (Lawrence Berkeley Lab., CA). *Health Physics;* 45: No. 2, 303-322(Aug 1983).

This paper reviews the literature on sources and measurement of natural airborne radionuclides and radiation in buildings. It also briefly reviews control measures and suggests areas for further research. The major emphasis is given to ^{222}Rn and its daughters, since they typically cause the largest organ dose to the general population, most of which arises from indoor exposures. The indoor radiation field from radionuclides fixed in building materials and soil is also given substantial treatment.

56333 Survey of radionuclide contents and radon emanation rates in building materials used in the US. Ingersoll, J.G. (Lawrence Berkeley Lab., CA). *Health Physics;* 45: No. 2, 363-368(Aug 1983).

Building materials commonly used in the US were surveyed for both radionuclide content and radon emanation rate. Particular emphasis was placed on concrete, for which samples from ten major metropolitan areas were measured. Gamma-ray spectroscopy techniques, as well as direct radon emanation measurements, were employed in this study. The results of this survey suggest that these materials are not the primary source of radon in typical US houses.

56334 Time-dependent method for characterizing the diffusion of ^{222}Rn in concrete. Zapalac, G.H. (Lawrence Berkeley Lab., CA). *Health Physics;* 45: No. 2, 377-383(Aug 1983).

The porosity and diffusion length of concrete have been determined by measuring the time-depedent diffusion of radon through a thin slab of the material. One surface of the slab is exposed to a large, fixed radon concentration beginning at $t = 0$. The radon that diffuses out of a portion of the opposite surface is collected during several contiguous time intervals. The total activity collected over a set of intervals beginning at $t = 0$ and the steady-state flux of activity are used to calculate the porosity and diffusion length. As a test of these parameters, they are then used to predict the activity collected during other time intervals and for other sample thicknesses. Samples from two types of concrete were tested. The predicted and experimental results agreed well, thereby

verifying the assumption that concrete may be treated as a homogenous diffusion medium for radon.

56335 **Radon concentrations and infiltration rates measured in conventional and energy-efficient houses.** Nero, A.V.; Boegel, M.L.; Hollowell, C.D.; Ingersoll, J.G.; Nazaroff, W.W. (Lawrence Berkeley Lab., CA). *Health Physics;* **45**: No. 2, 401-405(Aug 1983).

To elucidate any connection between high radon concentrations and low-infiltration houses, we have concurrently measured the ^{222}Rn concentration and the infiltration rate in US houses. Three housing surveys have been undertaken: one in energy-efficient houses located throughout the US and two in conventional houses in the San Francisco area and in Maryland. In each of the groups surveyed, no clear correlation was observed between ^{222}Rn concentrations and infiltration rate, although each parameter varied over a wide range. Infiltration rates for the entire sample, numbering 98 houses, ranged between 0.02 and 1.6 air changes per h, and ^{222}Rn concentrations ranged from 0.1 to 27 pCi/l. It appears that the major cause of the observed differences in ^{222}Rn concentration is variation from one house to another in the rate at which ^{222}Rn enters houses from its sources.

56336 **Radon daughter plateout. I. Measurements.** George, A.C.; Knutson, E.O.; Tu, K.W. (Environmental Measurements Lab., New York, NY). *Health Physics;* **45**: No. 2, 439-444(Aug 1983).

Radon daughter plateout (surface deposition) was measured directly in 1.9 and 20-m^3 chambers. To test the effect of different parameters on plateout, measurements were made over a wide range of particle concentrations and sizes. The results indicate that plateout is strongly dependent on particle concentration. The ratio of surface-deposited activity to total daughter activity in the chamber varied from 4% at particle concentrations $> 10^5/cm^3$ to 86% for particle concentrations $< 10^5/cm^3$. Comparison for the experimental data with a theoretical model shows that the theory overestimates plateout and underestimates the airborne concentration by factors of about 3.5 and 3.3, respectively.

56337 **Radon daughter plateout. II. Prediction model.** Knutson, E.O.; George, A.C.; Frey, J.J.; Koh, B.R. (Environmental Measurements Lab., New York, NY). *Health Physics;* **45**: No. 2, 445-452(Aug 1983).

By a linear programming procedure, we have optimized the Jacobi room model to fit our data on the partitioning of radon daughters between air and wall surfaces (plateout), obtained at high radon concentrations in a small chamber. Subsequently, the optimized model yielded estimates that compared well with plateout data obtained at lower concentrations in a room-sized chamber. The major change made in the Jacobi model was to reduce the deposition velocity of free airborne radon daughters from 1 to 0.05 cm/sec. This value was obtained by using a fast algorithm to solve the linear programming to arrive at the best fit. Lesser changes were made in other parameters.

56338 **Rapid spectroscopic technique for determining the potential α-energy concentration of radon decay products.** Revzan, K.L.; Nazaroff, W.W. (Lawrence Berkely Lab., CA). *Health Physics;* **45**: No. 2, 509-523(Aug 1983).

The application of α-spectroscopy to the rapid determination of the potential α-energy concentration (PAEC) of radon decay products indoors is considered. Two count totals are obtained after a single counting period. The PAEC is then estimated by a linear combination of the count totals, the two coefficients being determined by analysis of the dependence of the statistical and procedural errors on the equilibrium conditions and the sampling, delay and counting times. For a total measurement time of 11 min, the procedural error is unlikely to exceed 20% for equilibrium conditions commonly found indoors; the statistical error is less than 20% at a PAEC of 0.005 WL, assuming a product of detector efficiency and flow rate of at least 1.0 l/min. An analysis is made of techniques based on a total α count, and the results are compared with those obtained with the rapid spectroscopic technique; the latter is clearly preferable when the measurement time does not exceed 15 min.

56339 **Automated system for measuring air-exchange rate and radon concentration in houses.** Nazaroff, W.W.; Offermann, F.J.; Robb, A.W. (Lawrence Berkeley Lab., CA). *Health Physics;* **45**: No. 2, 525-537(Aug 1983).

An automated system for continuously measuring the air-exchange rate and ^{222}Rn (radon) concentration in an occupied residence has been developed. The air exchange rate is measured over 90-min intervals by tracer gas decay using sulfur hexafluoride as the tracer gas. The radon concentration is measured over 3-h intervals using a flow-through scintillation cell. Temperatures at up to seven points are measured every half hour. A microcomputer system controls the measurements, performs preliminary data analysis, and logs the data and the results. Continuous measurement of ventilation rate and radon concentration permits the effective radon source magnitude to be calculated as a function of time. The first field application of this system was a study in Rochester, NY, of residential air-exchange rates and indoor air quality.

56340 **Fast and accurate method for measuring radon exhalation rates from building materials.** Ingersoll, J.G.; Stitt, B.D.; Zapalac, G.H. (Univ. of California, Berkeley). *Health Physics;* **45**: No. 2, 550-552(Aug 1983).

An inexpensive, sensitive and relatively fast method for measuring radon emanation rates from building materials has been developed at Lawrence Berkeley Laboratory as part of its indoor air quality studies. The basic apparatus consists of a sealed chamber in which test samples are placed, a transfer system to transport the radon from the chamber to a small alpha-scintillation cell, a photomultiplier tube counting system to count the alpha decays in the scintillation cells, and a calibration system. The operation of the whole system is described. (KRM)

5006 Regulations

REFER ALSO TO CITATION(S) 55419, 55833

56341 **(EPA—450-3-80-036b) Beverage can surface coating industry: background information for promulgated standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Aug 1983. 66p. NTIS, PC A04/MF A01.

On November 26, 1980, the Environmental Protection Agency (EPA) proposed standards of performance for the beverage can surface coating industry (45 CFR 78980) under authority of Section 111 of the Clean Air Act. Public comments were requested on the proposal in the Federal Register. Eighteen comments were received, mostly from beverage can makers. Also commenting were State air pollution control agencies, coating suppliers, a trade association, and federal agencies. Four presentations were made at the public hearing on January 6, 1981. The comments that were submitted, along with responses to those comments, are summarized in this document. The summary of comments and responses serves as the basis for the revisions made to the standards between proposal and promulgation.

56342 **(NP—3770385) Clean air technical guide.** (Institut fuer Gewerbliche Wasserwirtschaft und Luftreinhaltung e.V. (IWL), Koeln (Germany, F.R.)). 1981. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770385.

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This volume contains seven contributions critically reviewing the Clean Air Technical Guide of 1981 and the Ordinance for the control of emissions from industrial-scale furnace systems. The subjects dealt with are shown by the titles, which are as follows: - Basic legal and political conditions governing the draft amending the Clean Air Technical Guide of 1981 and the Ordinance for the control of emissions from industrial-scale furnace systems. - Clean Air Technical Guide 1981: The new limits for cancerogenics. - Clean Air Technical Guide 1981: The new limits for lead and cadmium emission. - Clean Air Technical Guide 1981: Boundary conditions of the applicability of nomograms for stack height determination - The problem of determining maximum sulphur emission from low-lying pollutant sources at weak mass flows. - Clean Air Tech-

nical Guide: Analysis of proposed measuring and evaluation methods. - Examination of the co-ordination of methods. - New regulations for monitoring and control of industrial plants in accordance with proposed amendments to the Clean Air Technical Guide and to the Ordinance for the control of emissions from industrial-scale furnace systems. - Industrial-scale furnace systems: Methods of detecting and evaluating emissions exceeding the limits.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 56353, 56356

56343 (NP—3770386, pp 51-76) **Ecosystem: Riparian forest.** Margl, H. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

The composition of the riparian forest consisting in different species shows a strictly regular structure depending on the site elevation above water level and on the age of the soils. Elevation levels are designated according to the water household and classified according to indicator plants as wet, moist, fresh, dry and arid sites. The younger zone near the water consiting of softwood trees and the older zone farther way composed of hardwood trees are called softwood and hardwood lowland.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 55499

56344 (PB—83-201962) **User's manual for the chemical transport and fate model (TOXIWASP), Version 1. Final report Mar 81-Nov 82.** Ambrose, R.B. Jr; Hill, S.I.; Mulkey, L.A. (Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab.). Mar 1983. 189p. (EPA—600/3-83-005). NTIS, PC A09/MF A01.

This manual describes the dynamic model TOXIWASP for simulating the transport and fate of toxic chemicals in water bodies. TOXIWASP combines the kinetic structure adapted from the Exposure Analysis Modeling System (EXAMS) with the transport framework provided by the Water Analysis Simulation Program (WASP), along with simple sediment balance algorithms. TOXIWASP formulates variable chemical degration rates from chemical characteristics of a compound and the environmental parameters of the aquatic system. These rates combine calculated first order rates due to several processes, including hydrolysis, biolysis, photolysis, oxidation, and volatilization. Sorption onto sediments and onto biomass is calculated assuming local equilibrium, using a chemical specific partition coefficient, and spatially varying environmental organic carbon fractions.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 55527, 55528, 55537, 55538, 55548, 55550, 56332, 56333, 56369

56345 (EGG—10282-1003) **In-situ gamma-analysis support for Phase I, Middlesex cleanup project, Middlesex, New Jersey.** Reiman, R.T. (EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group). Jul 1983. Contract AC08-83NV10282. 24p. NTIS, PC A02/MF A01. Order Number DE84000177.

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At the request of the Department of Energy, the Energy Measurements Group of EG and G participated in the Remedial Action program for the former Middlesex Sampling Plant and associated properties at Middlesex, New Jersey from July to November 1980. EG and G provided real time analysis of the radiological character of the soil of each property included in the Phase I cleanup before, during, and after decontamination. The method used for the analysis was in situ gamma spectroscopy employing a high purity germanium detector. This report describes the in situ system and displays the results of the in situ measurements before and after decontamination of the properties surveyed during Phase I.

56346 (EGG—10282-1005) **Aerial radiological survey of the Washington. Date of survey: July 1982 Public Power Supply System (WPPSS) Nuclear Project and surrounding area, Richland, Washington.** (EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group). Jul 1983. Contract AC08-83NV10282. 12p. NTIS, PC A02/MF A01. Order Number DE84001011.

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An aerial radiological survey was performed from 14 to 20 July 1982 over a 270-square-kilometer area centered on the Washington Public Power Supply System (WPPSS) Nuclear Project located near Richland, Washington. All gamma ray data were collected by flying parallel lines spaed 152 meters (500 feet) apart at an altitude of 91 meters (300 feet) above ground level. Count rates obtained from the aerial platform were converted to total external exposure rates at 1 meter above the ground and are presented in the form of an isoradiation contour map. The observed exposure rates ranged from 5 to 15 microroentgens per hour (μR/h) with the average background ranging from 9 to 12μR/h. These values include an estimated cosmic ray contribution of 3.7 μR/h. The exposure rates obtained from ground-based measurements taken in background locations within the survey area displayed positive agreement the aerial data.

56347 (INIS-mf—8560, pp vp) **Radioactive contamination of environment.** Chytil, I. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8108164—Pt.1-Vol.2).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

A computer model is discussed describing radioactivity transport between the source and the organism. The model is to be applied in assessing the effect of a nuclear installation on the organism. Fortran and Pascal appear to be the most appropriate computer languages. With respect to internal memory requirements, the program file is estimated to consist of a control program and a number of subprograms. Upon setting the radioactivity transport and the output requirements the control program should recall the necessary subprograms. The program file should allow the complete data file and the solutions of all possible radioactivity transport variants to be inputted. It is envisaged that several subprograms will be available for one type of radioactivity transport, this depending on different accuracy of the transport description. Thus, the requirements for input data will also differ.

56348 (KFK—3435) **Hydrogeological conditions of Karlsruhe Nuclear Research Centre - preliminary studies in the course of the R and D project.** Tenhaeff, G.; Jakubick, A.T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Jan 1983. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750999.

The report investigates the hydrogeology of a potential site in the vicinity of the Nuclear Research Centre, Karlsruhe under the assumption that disposal will take place in the Bunter Sandstone Formation. The total dissolved solids content of the deep groundwater of the injection formation is distinctly higher than that of the Quarternary and Pliocene aquifers. (1) The saline water occurs already in the Upper Miocene strata, (2) no hydraulic connection exists between the Pliocene aquifer and the deeper aquifers and (3) no active movement exists below the Pliocene basis. For the upper and middle aquifer of the Quarternary an average hydraulic conductivity of $k=0{,}95\times10^{-3}$ m/s is estimated. The transmissivity amounts to $T=0.03$ m²/s. During winter 1979/1980 we conducted a natural-gradient tracer test with 200 g fluorescene in the upper aquifer near the oil well Lh 2. The local tracer pathline coincides with the general direction of flow. The average linear velocity

varied from 0.65 m/d to 1.29 m/d. From the spreading of the tracer one can calculate a longitudinal dispersion coefficient of D=0.77 m^2/d and a transversal dispersion coefficient D=0.006 m^2/d. In case of a groundwater contamination of the Quarternary upper aquifer with tritium, the contamination would move northwest. As the lateral spread of contamination would be very limited no effect on the Waterwork Leopoldshafen can be expected.

56349 **(PNL—4658) Environmental status of the Hanford Site for CY 1982.** Sula, M.J.; Blumer, P.J.; Dirkes, R.L.; Carlile, J.M.V. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 70p. NTIS, PC A04/MF A01. Order Number DE84001254.

Samples of air, surface water, soil, vegetation, and wildlife were collected and external penetrating radiation dose measurements were made in the vicinity of the major operating areas on the Hanford Site. The samples were analyzed for radioactive constituents including tritium, strontium-90, plutonium, and gamma-emitting radionuclides. In addition, site roads, railroad tracks, and burial grounds were surveyed periodically to detect any abnormal levels of radioactivity. Radioactive and nonradioactive waste discharges and environmental related unusual occurrences reported for the major operating areas were reviewed and summarized.

56350 **(PNL—4801) Allowable Residual Contamination Levels in soil for decommissioning the Shippingport Atomic Power Station site.** Kennedy, W.E. Jr.; Napier, B.A.; Soldat, J.K. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 50p. NTIS, PC A03/MF A01. Order Number DE84001310.

As part of decommissioning the Shippingport Atomic Power Station, a fundamental concern is the determination of Allowable Residual Contamination Levels (ARCL) for radionuclides in the soil at the site. The ARCL method described in this report is based on a scenario/exposure-pathway analysis and compliance with an annual dose limit for unrestricted use of the land after decommissioning. In addition to naturally occurring radionuclides and fallout from weapons testing, soil contamination could potentially come from five other sources. These include operation of the Shippingport Station as a pressurized water reactor, operations of the Shippingport Station as a light-water breeder, operation of the nearby Beaver Valley reactors, releases during decommissioning, and operation of other nearby industries, including the Bruce-Mansfield coal-fired power plants. ARCL values are presented for 29 individual radionculides and a worksheet is provided so that ARCL values can be determined for any mixture of the individual radionuclides for any annual dose limit selected. In addition, a worksheet is provided for calculating present time soil concentration value that will decay to the ARCL values after any selected period of time, such as would occur during a period of restricted access. The ARCL results are presented for both unconfined (surface) and confined (subsurface) soil contamination. The ARCL method and results described in this report provide a flexible means of determining unrestricted-use site release conditions after decommissioning the Shippingport Atomic Power Station.

56351 **(PNL-SA—11221) Estimating the spatial pattern of radionuclides in the environment using kriging.** Gilbert, R.O.; Simpson, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 45p. (CONF-830899—1). NTIS, PC A03/MF A01. Order Number DE83016741.

From Annual meeting of American Statistical Association and other statistical groups; Toronto, Canada (15 Aug 1983).

The purpose of this paper is two-fold: (1) to increase awareness within the statistical community of kriging methods for estimating spatial patterns and amounts of environmental pollutants and other phenomenon, and (2) to illustrate using a large radionuclide data set some of the estimation biases and other difficulties that can arise when using kriging techniques. Kriging techniques are relatively unknown to statisticians in the United States except for those involved in geology, mining or environmental studies. The method has potential for application in some environmental pollution studies, but improved statistical methods for estimating the underlying spatial correlation structure and in quantifying the uncertainty in estimates of spatial pollution concentration contours are needed. Design questions should also be addressed. Kriging is applied to the radionuclide data set to obtain estimates of concentration isopleths (contours of constant concentration), confidence bands about those contours, average concentrations over 50' by 50' block areas, and the inventory (total amount) of ^{241}Am in surface soil. The effect on these estimates of a nonstationary semi-variogram (a function giving the correlation structure) over the study site is studied by dividing the site into more homogeneous zones and using a separate semi-variogram model for each zone. 37 references.

56352 **(UCRL—52853-Pt.5) Northern Marshall Islands Radiological Survey: a quality-control program for a radiochemical analyses.** Jennings, C.D.; Mount, M.E. (Lawrence Livermore National Lab., CA (USA)). Aug 1983. Contract W-7405-ENG-48. 75p. NTIS, PC E04/MF A01. Order Number DE84000658.

Includes 1 sheet of 48x reduction microfiche.

More than 16,000 radiochemical analyses were performed on about 5400 samples of soils, vegetation, animals, fish, invertebrates, and water to establish amounts of ^{90}Sr, ^{137}Cs, ^{241}Am, and plutonium isotopes in the Northern Marshall Islands. Three laboratories were contracted by Lawrence Livermore National Laboratory to perform the radiochemical analyses: Environmental Analysis Laboratory (EAL), Richmond, California; Eberline Instrument Corporation (EIC), Albuquerque, New Mexico; and Laboratory of Radiation Ecology (LRE), University of Washington, Seattle, Washington. The analytical precision and accuracy were monitored by regularly including duplicate samples and natural matrix standards in each group of about 100 samples analyzed. Based on the duplicates and standards, over 83% of the radiochemical analyses in this survey were acceptable - 97% of the analyses by EAL, 45% of the analyses by EIC, and 98% of the analyses by LRE.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 55510, 55532, 55535

5106 Regulations

REFER ALSO TO CITATION(S) 56350

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 56343, 56523, 56524

56353 **(BNL—33715) Viruses in soil and groundwater.** Vaughn, J.M.; Landry, E.F. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 136p. NTIS, PC A07/MF A01. Order Number DE84001267.

Human viruses usually gain access to soil systems through intentional or unintentional discharges of domestic wastewater. Intentional land treatment/disposal systems represent an attractive alternative to surface water discharges, providing both economic and environmental advantages. Major concerns over the possible threat to human health as a result of the large-scale use of such systems are as yet unresolved. One such concern involves the potential for viral contamination of groundwater systems which currently supply the drinking-water needs of half the United States population. While no groundwater-borne disease outbreaks of viral etiology have as yet been associated with land treatment use, the potential for their occurrence has been clearly indicated by epidemiological studies of outbreaks associated with groundwater pollution from unintentional modes of soil application. Epidemiological evidence has been supported by an increasing number of field studies which have demonstrated viral contamination of shallow aquifers resulting from the use of various land treatment modes, such as rapid infiltration/recharge systems. More recent studies have indicated that soil-

associated microbial pollution of groundwater may be abated by the use of systems management practices based upon an understanding of the physical and chemical factors which influence viral retention in soil including: temperature; pH; moisture, clay and ion content; depth to groundwater; infiltration rate; and soil continuity. The proper manipulation of these principles in the operation of land treatment schemes which utilize high-quality wastewater effluents should provide the means for significantly diminishing the likelihood of viral movement to groundwater systems.

56354 (NP—3770386) **Ecology of running waters - bio-engineering safeguarding measures.** (Technische Univ., Vienna (Austria). Inst. fuer Wasserguete und Landschaftswasserbau; Oesterreichische Gesellschaft fuer Natur- und Umweltschutz, Vienna). 1982. 275p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83770386.

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The seminars serve the cooperation between the Institute for Water Quality and Aquatic Landscape Engineering of the Vienna Technical University and the Austrian Society for the Protection of Nature and Environment. Large circles of the population are to be informed on the consequences of living-space destruction.

56355 (NP—3770386, pp 21-50) **Ecological impact of plant associations growing on running waters.** Wolkinger, F. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

The ecological importance of hydrophytes and helophytes is demonstrated by means of herbaceous plant associations and their arrangement in and alongside running waters. Plant associations at running or still waters do not only mirror the habitat conditions of their biotope but also serve as excellent bio-indicators for the overall-condition of the biotope.

56356 (NP—3770386, pp 77-96) **Plants growing on running waters and their site conditions.** Vitek, E. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

Demonstration of the site conditions of individual, esp. typical plants and plant associations. Explanation of the values of moisture, reaction, nutrient, light, temperature, continentality, humus and dispersity. Tables give a survey on properties of ligneous species, Rubus species and herbaceous perennial plants.

56357 (NP—3770386, pp 139-188) **Bio-engineering and combined construction methods on running waters.** Schiechtl, H.M. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

Counter to their natural growth of reed banks or woody plant vegetation, the lowland woods covering the valley bottom were reduced to narrow edges in the course of man's settlement. 80% of these woods were lost in the last 10 years. And along with them, valuable retention areas were lost at the same time. This makes bio-engineering construction methods appear to be more vital wherever applicable.

56358 (NP—3770386, pp 190-216) **Plant selection, plant pro curement, maintenance, cost.** Schiechtl, H.M. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

In the planning of extensive construction by bio-engineering, the plant species involved are selected according to ecological conditions, their vegetative propagationability, their bio-technical suitability, their strength of development and performance of growth as well as according to the objective, the useful effect and landscape-architectural impact. A list of salient woody species suitable for running-water sites is given.

56359 (NP—3770386, pp 217-242) **Performance calculation of near-natural and natural water bodies.** Indlekofer, H. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

As to the hydraulic calculation method there is no difference between a naturally grown running water and a near-naturally engineered one. Essential differences, however, will be noted in geometric detail with cross section and ground plot course. Whereas running waters will show a more complicated morphology in their natural state, more simply established geometrical elements of running waters may be taken as a basis in the regulated state. In as much as the establishment of the hydraulic effect of a single plant or of their totality is concerned, there are no differences between natural and near-natural state.

56360 (NP—3770386, pp 243-262) **Experience gained with bio-engineering measures performed on running waters in mountains.** Florineth, F. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

Combined methods providing some initial protection are mostly employed. At individual torrent sections, esp. the upper drainage areas, the eroded areas are grassed and reforested. The upper, middle and lower part of torrents mostly are either so steep or carry so much bed load during high water that purely biological regulation methods employing e.g. willows and saplings or wildings with roots are not indicated.

56361 (NP—3770386, pp 263-276) **Experience gained with bio-engineering measures performed on running waters in the Alpine foothills.** Rossoll, A. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

Most of the large waters are stable and regulations, as a rule, cannot be advocated for economic reasons. The application of living plants as construction elements will largely be limited to maintenance and damage repair. This applies especially to Upper Austria with its numerous surface waters of the Alpine foothills.

56362 (NP—3770386, pp 277-295) **Countryside preservation - bio-engineering safeguarding measures with running waters in Bavaria.** Karl, J. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

Methodology and possible administrative measures of countryside preservation of waters in Bavaria are demonstrated by means of examples. With the exception of the actual lowland rivers, all types of Central European running waters are found. A water body preservation scheme is being worked out as a basis for maintaining the waters. It comprises regularly valley landscapes influenced by high water and torrents.

56363 (ORNL/TM—8447) **Distribution and habitat selection of adult striped bass, Morone saxatilis (Walbaum), in Watts Bar Reservoir, Tennessee.** Cheek, T.E.; Van den Avyle, M.J.; Coutant, C.C. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 289p. NTIS, PC A13/MF A01. Order Number DE84000195.

Thesis. Submitted by T.E. Cheek to Tennessee Technological Univ., Cookeville.

Biotelemetry was used to determine seasonal distribution patterns and habitat preferences and to evaluate factors affecting movements of adult striped bass (Morone saxatilis) in Watts Bar Reservoir, Tennessee. Distribution and movement of striped bass were strongly influenced by water temperature. Mean distances moved per day during spring and winter were similar but significantly higher than rates for summer and fall. During spring, striped bass moved into headwater areas as water temperatures approached those associated with spawning (15° to 19°C). Brief habitation of the main body of the reservoir was noted during summer prior to movement to cool-water refuges located in the Clinch River and

Tennessee River arms. No striped bass were located in the main body of the reservoir in early fall when temperatures ranged from 24° to 25°C. Fish were located in thermal refuges during this period and occupied water temperatures averaging 20.5°C. The only extended period of striped bass habitation of the main body of the reservoir occurred in winter, when the fish occupied a mean water temperature of 11°C. Although distribution was restricted during warmer seasons, individual fish moved freely throughout the 116-km-long reservoir at other times, indicating that subpopulations did not exist. 64 references.

56364 **Solubility behavior of atmospheric ^{7}Be in the marine environment.** Bloom, N.; Crecelius, E.A. (Battelle-Northwest, Sequim, WA (USA). Marine Research Lab.). *Marine Chemistry (Amsterdam);* **12**: No. 4, 323-331(Apr 1983).

The solubility of natural ^{7}Be from air particulate matter in seawater was determined as a function of time. Adsorption of the thus solubilized ^{7}Be on a variety of substrates was investigated. ^{7}Be appears to be strongly adsorbed on suspended matter and inorganic materials at high suspended loads (>20 mg l^{-1}), but at natural levels (approximately 1 mg l^{-1}) is only partially adsorbed. Further, at natural concentrations of suspended matter, adsorption of ^{7}Be appears to be directly proportional to suspended load. Because a non-steady-state flux of ^{7}Be to the bottom could be expected over its 53-day half-life, ^{7}Be may be a poor tracer of sedimentation rates and sediment redistribution processes.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 55456, 56309

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 55496, 55501, 55506, 55537, 55547, 56347, 56349, 56369

56365 **(GSF-R—313) New insights into the chemical behaviour of radioiodine in aquatic environments.** Behrens, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). Apr 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751000.

Reprint from "Environmental migration of long-lived radionuclides" (IAEA-SM—257/36).

It was found that in surface fresh water and in soil water iodine is to a large extent chemically converted by processes which are instigated by microbial action. The reactions involve extracellular oxidation of iodide with subsequent incorporation of the iodine into organic compounds, probably proteins. Furthermore it was found that iodate is reduced, probably also by a biochemical reaction. This reduction is more pronounced in soil than in surface water. In surface fresh water the formed organic radioiodine compounds are mainly in solution. In soils the radioiodine becomes to a larger extent bound to insoluble organic substances by these processes. The dissolved form of organic iodine is not precipitable as silver halide. Some other chemical and physico-chemical properties are described. Details on how the iodine conversion influences its fixation processes in soil are given. Possible consequences of these reactions on the migration behaviour of radioiodine and on the performance as well as on the interpretation of experiments in this context are discussed.

56366 **Reversible ion-exchange of cesium-137 leading to mobilization from reservoir sediments.** Evans, D.W.; Alberts, J.J.; Clark, R.A. III (Savannah River Ecology Lab., Aiken, SC (USA)). *Geochimica et Cosmochimica Acta;* **47**: No. 6, 1041-1049(Jun 1983).

The radioactive fission product, ^{137}Cs, has been observed to mobilize from bottom sediments of two South Carolina reservoirs during summer thermal stratification and hypolimnetic anoxia. Mobilization is attributed to ion-exchange displacement of ^{137}Cs from sediments by cations such as NH_4^+, Fe^{+2} and Mn^{+2} released under anaerobic conditions. Three types of ^{137}Cs binding sites to sediment clay minerals are identified: 1) surface and planar sites from which ^{137}Cs is generally exchangeable by all cations studied; 2) wedge sites where ^{137}Cs exchange is sterically limited to cations of similar size and charge; 3) interlayer sites from which ^{137}Cs is not readily exchanged. More than 15 years after final ^{137}Cs inputs, the reservoir sediments we studied showed the following percentage distribution of sites: 2 to 9% surface sites, 6 to 13% wedge sites, and 78 to 85% interlayer sites. In contrast, lake and stream sediments near Oak Ridge, Tennessee receiving ^{137}Cs inputs more than 20 years earlier had greater than 99% of their ^{137}Cs associated with non-exchangeable interlayer sites. The difference is attributed to the paucity in the South Carolina sediments of weathered micaceous clay minerals with their abundant interlayer sites. Such interlayer deficient clays are dominant in the Atlantic and Gulf coastal plains of the United States and elsewhere.

56367 **Survey of the radioactive background of some specimens of the biota of Rio de Janeiro coastal waters.** dos Santos, P.L.; Santos Gouvea, R. de C. dos; Azevedo Gouvea, V. de. Niteroi, Brazil; Universidade Federal Fluminense ([nd]). 17p. (In Portuguese).

The natural radioactivity of components known to be bioconcentrators of artificial radionuclides in the coast of Rio de Janeiro was determined by means of systematical gross alpha and beta radiometry. These data constitute the pre-operational survey, determining the radioactivity levels of these organisms and permitting to establish basic values and their temporal variations, which will serve as a reference for the detection of eventual increases in the radioactivity introduced in the marine environment during the operational phase of nuclear power plants. Uranium and potassium were also measured in some samples. The maximum and minimum values obtained after six years of experiment, analysing 14 species of algae and 4 species of animals were: for gross alpha radiometry (0,454 + - 0,162)Bq/g in the ashes of the phaeophita Padina vickersiae and (0,473 + - 0,106)Bq/g in the cnidaria Bunodosoma caissarum, (0,067 + - 0,031)Bq/g in the clorophita Ulva Fasciata and (0,091 + - 0,060)Bq/g in the soft tissues of the bivalve Perna perna. The byssus of this animal presented the highest gross alpha concentration : (1,770 + - 0,708)Bq/g, probably due to its high uranium concentration, which contributes with 71%, complexed with its main constituent, a scleroprotein. The gross beta concentrations were highest in the algae Chetomorpha antennina (6,63 + - 1,80)Bq/g and in the species Bunodosoma caissarum, with a mean value of (2,60 + - 0,74)Bq/g in the ashes. The lowest concentrations were obtained in the rodophita Plocamium brasiliense, (1,64 + - 0,36)Bq/g, and (1,04 + - 0,30)Bq/g in the byssus of Perna perna. By the theoretical concentration of ^{40}K, calculated from potassium, the strong contribution of that radionuclide in the gross beta activity of the organisms is stressed. Seven samples of ashes were submitted to analyses by three different laboratories and the intercomparison results showed a reasonable agreement.

5204 Thermal Effluents Monitoring And Transport

56368 **(N—8324998) LANDSAT-4 image data quality analysis for energy related applications.** Wukelic, G.E. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. 11p. (E—83-10295; NASA-CR—170326). NTIS, PC A02/MF A01.

No useable LANDSAT 4 TM data were obtained for the Hanford site in the Columbia Plateau region, but TM simulator data for a Virginia Electric Company nuclear power plant was used to test image processing algorithms. Principal component analyses of this data set clearly indicated that thermal plumes in surface waters used for reactor cooling would be discrenible. Image processing and analysis programs were successfully testing using the 7 band Arkansas test scene and preliminary analysis of TM data for the Savanah River Plant shows that current interactive, image enhancement, analysis and integration techniques can be effectively used for LANDSAT 4 data. Thermal band data appear adequate for gross estimates of thermal changes occurring near operating nuclear facilities especially in surface water bodies being used for reactor cooling purposes. Additional image processing software was written and tested which provides for more rapid and effective analysis of the 7 band TM data.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 55510

56369 **(DOE/EA—0209) Environmental assessment, Pinellas Plant site, Petersburg, Florida.** (USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of Military Application). Jul 1983. 128p. NTIS, PC A07/MF A01. Order Number DE83017627.

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The purpose of this environmental assessment is to describe the operations at the Pinellas Plant, discuss the locale in which the plant is situated and assess the actual and possible impacts of plant operation on the surrounding environment. The facility and the local environment are described; impacts on the economy, local community and the environment discussed, and alternatives presented. A comparison of the environmental impact of operating the Pinellas Plant versus the benefits gained by its operation suggests that the plant should continue its function of supplying nuclear weapons components for the US Department of Energy.

56370 **(NP—3770393) Implementing the factor of environment into the theory of economic growth.** Sauer, K.M. (Mainz Univ. (Germany, F.R.). Fachbereich Rechts- und Wirtschaftswissenschaften). 16 Dec 1981. 263p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83770393.

Portions are illegible in microfiche products; Thesis.

The thesis deals mainly with the problem of in how far the development of the economic activity can be influenced, taking into consideration the environmental factors on the sector of environmental quality and resources. It can be said briefly that the environmental factors which we are running short of require a comprehensive restructuring of the economic process of production. In how far these necessary restructuring measures are accompanied by losses in the growth of economic activities depends on the prevailing flexibility of the economic system concerned.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 55845

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 55582

56371 **(DOE/EIS—0097-F) Transmission Facilities Vegetation Management Program. Final environmental impact statement.** (Bonneville Power Administration, Portland, OR (USA); USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). Aug 1983. 486p. NTIS, PC A21/MF A01. Order Number DE84001222.

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The proposed program would manage vegetation on some 84,000 acres of rights-of-way and at 357 substations and other facilities throughout BPA's seven-state service area. On rights-of-way, tall-growing vegetation would be prevented from growing into transmission lines and from blocking access roads. At substations and microwave yards, all vegetation would be removed to prevent fire and safety hazards. Where appropriate, noxious weeds would be controlled in cooperation with local landowners. The Proposed Program would use manual, spot chemical, broadcast chemical, and biological methods to manage vegetation. Selection of treatments to use in specific management situations would be based on consideration of social, ecological, and economic consequences of using the various methods. Treatments would be implemented according to the constraints and mitigation measures provided by BPA's Transmission Line Maintenance Standard. This EIS examines potential impacts on public health, worker safety, water quality and fisheries, land uses, plants and animals, soils, and visual, cultural, and historical resources. In particular, the potential impacts of using herbicides in spot chemical and broadcast chemical treatments are examined.

56372 **(DOE/EIS—0097-F-App.) Transmission Facilities Vegetation Management Program. Final environmental impact statement. Appendices.** (Bonneville Power Administration, Portland, OR (USA); USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). Aug 1983. 225p. NTIS, PC A10/MF A01. Order Number DE84001230.

The proposed program would manage vegetation on some 84,000 acres of rights-of-way and at 357 substations and other facilities throughout BPA's seven-state service area. This EIS examines potential impacts on public health, worker safety, water quality and fisheries, land uses, plants and animals, soils, and visual, cultural, and historical resources. In particular, the potential impacts of using herbicides in spot chemical and broadcast chemical treatments are examined. These appendices contain herbicide background statements, average number of right-of-way acres programmed for treatment per year per county, and landscape types in the BPA service area. (ACR)

56373 **(DOE/EIS—0102-F) 1983 wholesale power rate. Final environmental impact statement.** (Bonneville Power Administration, Portland, OR (USA); USDOE, Washington, DC). Sep 1983. 425p. NTIS, PC A18/MF A01. Order Number DE84000922.

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This statement addresses the potential environmental effects of a wholesale power rate increase by Bonneville Power Administration (BPA). This action applies to the Pacific Northwest region and other areas, particularly California, which purchase power from BPA. Five different rate levels are analyzed. These range from a base rate alternative, the lowest level of rates, to a long run incremental cost (LRIC) alternative, the highest level. The no action alternative, the direct financing alternative, and the proposed alternative fall between these extremes. The proposed alternative reflects BPA's initial rate proposal, which increases the Priority Firm and Industrial Firm Power rates by 27 percent and 5 percent respectively, for the rate period November 1, 1983, through June 30, 1985. Analyses have also been conducted concerning the effects of alternative rate structures. The existing and proposed rates are time differentiated and contain a variety of features to increase the efficiency of use of BPA's resources, and to minimize the need to construct or operate additional resources. This minimizes the environmental effects from resource construction and operation. Measures which mitigate the impact of wholesale power rate increases include BPA's conservation programs, rate design features which maximize efficiency, and others which reduce the level of rates for particular customer groups.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 56171, 56382, 56412

56374 **(CONF-8308110—5) Chemical and physical characterization of the activation of ribulosebiphosphate carboxylase/oxygenase.** Donnelly, M.I.; Ramakrishnan, V.; Hartman, F.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE83017226.

From 6. international congress on photosynthesis; Brussels, Belgium (1 Aug 1983).

Molecular structure of ribulosebiphosphate carboxylase/oxygenase isolated from Rhodospirillium was compared with the enzyme isolated from Alcaligens eutrophus. Peptides derived from

the active center of the bacterial enzyme were highly homologous with those isolated from spinach. Molecular shapes of the carboxylases were estimated using neutron scattering data. These studies suggested that the enzyme as isolated from R. rubrum is a solid prolate ellipsoid or cylinder, while the spinach enzyme resembles a hollow sphere. 1 drawing.

56375 **(DOE/EV/05854—6) Repair of lesions and initiation of DNA replication in vertebrate cells. Progress report, February 1, 1983-January 31, 1984.** Taylor, J.H. (Florida State Univ., Tallahassee (USA)). 1983. Contract AS05-78EV05854. 14p. NTIS, PC A02/MF A01. Order Number DE84000832.

Annual progress report covering studies focused on (1) characterization of the number of dispersed repeats of a Xenopus Xori genome segment, chosen as best replicator in microinjection studies of Xenopus eggs, (2) effect of DNA methylation on strand repair of base pair mismatches, and (3) the search for RNA primers at sites of replication origins. Authors estimate that about 200,000 copies of the repeat are hybridized to the Xori probe in a genome size of about 4 pg of DNA.

56376 (LMF—102, pp 256-258) **Partial purification of rabbit nasal cytochromes P-450.** Dahl, A.R.; Hall, L.L.; Hadley, W.M. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Cytochrome P-450 from the nasal cavities of rabbits was solubilized and partially purified using procedures previously used in purification of lung cytochrome P-450. Characteristics similar to lung cytochrome P-450 were observed but certain differences were also apparent. The results encourage further efforts to isolate and characterize rabbit nasal cytochrome P-450.

56377 (LMF—102, pp 259-264) **Biotransformation enzymes in rat nasal epithelial membranes.** Bond, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Respiratory tract biotransformation of many xenobiotics found in inhaled environmental pollutants is generally considered essential for the mutagenic, carcinogenic, and/or toxic response of lung tissue to these xenobiotics. Environmental pollutants contain known carcinogens adsorbed onto particles which can deposit in the respiratory tract, including the nasal-pharyngeal region. This study characterized the metabolic capacity of rat nasal tissue. Oxidative and nonoxidative enzymes that were investigated included aryl hydrocarbon hydroxylase (AHH), epoxide hydrolase (EH), UDP-glucuronyl transferase (UDPGT), and glutathione transferase (GSHT). Specific activities of AHH, EH, UDPGT, and GSHT were 0.023, 6.4, 20.4 and 24.8 nmoles product/mg protein/min, respectively. The BaP was metabolized by AHH to dihydrodiols, quinones and phenols in quantities that were about 10 times greater than those reported for rat lung microsomes. Small, but detectable, quantities of BaP-tetrols were also formed. The results from this study support the hypothesis that nasal tissue may be important in determining the metabolic fate of inhaled xenobiotics.

56378 **Neutron structure of and thermal motion in γ-aminobutyric acid (GABA) at 122 K.** Weber, H.P. (Kiel Univ. (Germany, F.R.)); Craven, B.M. (Pittsburgh Univ., PA (USA)); McMullan, R.K. (Brookhaven National Lab., Upton, NY (USA)). *Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry;* **39**: No. 3, 360-366(1 Jun 1983).

At 122 K, γ-aminobutyric acid ($C_4H_9NO_2$) is monoclinic, space group $P2_1/a$, with a = 8.214(2), b = 10.000(2), c = 7.208(2) A, β = 110.59(2)°. A structure refinement by full-matrix least squares based on 1686 neutron reflections (sin theta/lambda < 0.78 A^{-1}) has converged with Rsub(w)(F^2) = 0.044. Bond lengths and angles involving nuclear thermal centroids have e.s.d.'s less than 0.002 A and 0.2° respectively, including those with H atoms. Because of marked anisotropy in atomic and molecular vibrations, thermal corrections to the bond lengths are important. These have been determined taking intramolecular modes of vibration into account. A novel aspect of the thermal-motion analysis is the inclusion of anharmonic thermal-motion corrections for the C-H bonds. They are found to be similar in magnitude and opposite to the harmonic corrections (approximately 0.02 A). The six C-H bond lengths before and after correction lie within the range 1.093-1.099 A and 1.099-1.103 A respectively. The C(trig.)-C(tetr.) bond may be longer (1.534 A) than the C(tetr.)-C(tetr.) bonds (mean value 1.527 A). There are three strong N-H...O hydrogen bonds with similar geometries (H...O distances: 1.69, 1.71, 1.74 A; uncorrected).

56379 **Peak-shape analysis for protein neutron crystallography with position-sensitive detectors.** Schoenborn, B.P. (Brookhaven National Lab., Upton, NY (USA)). *Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography;* **39**: No. 3, 315-321(1 May 1983).

In neutron protein crystallography, the use of position-sensitive detectors controlled by a modern data-acquisition system permits new approaches to data-collection strategies. Instead of dealing with conventional scans, like the theta-2theta scan, that provide an integrated intensity as a function of a rotational parameter, the computer-linked counter can be used to produce a three-dimensional reflection profile. As the crystal steps ($\Delta\omega$) through a reflection, the observed data for each step are stored in an external memory as a function of extent in 2theta and height (y) of a reflection. In this space, the reflection will be a three-dimensional distribution with dimensions determined by such basic geometrical conditions as Δlambda, crystal size, mosaic spread, counter-resolution, and beam-collimation parameters. Knowledge of the interaction of these basic parameters will allow the design of optimal beam optics and will permit the delineation of the reflection from the background and permit, therefore, an accurate intensity determination.

56380 **Stability of thin viscoelastic films with applications to biological membrane deformation.** Jain, R.K. (Carnegie-Mellon Univ., Pittsburgh, PA); Maldarelli, C. *Annals of the New York Academy of Sciences;* **404**: 89-102(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

The linear stability of thin films has many interesting biological and industrial applications. This article has focused only on the biological applications. Considering a membrane to be an isotropic and transversely isotropic film on the order of 10 nm in thickness, we have examined the role of film rheology, Marangoni effects, van der Waals forces, electrical interactions, and asymmetry on the stretching and squeezing modes of instability. The results are in general agreement with the experimental data available. 16 references.

56381 **The human protein index: a prospect for laboratory medicine.** Anderson, N.G.; Anderson, N.L. (Argonne National Lab., IL). *Laboratory Management;* **20**: 25-32(Jun 1982).

A description is given of an annotated human protein index constructed with the use of new, high-resolution separation techniques combined with computerized image analysis, data reduction and data-base organization and management methods. Isoelectric focusing and gel electrophoresis have been combined in a two-dimensional procedure which should be capable of separating more than 10,000 proteins. Uses of the protein map in molecular pathology and biotechnology are discussed.

5503 Cytology

REFER ALSO TO CITATION(S) 56469

5505 Metabolism

REFER ALSO TO CITATION(S) 56185

56382 (BNL—33553) Kinetic and spectroscopic studies of cytochrome b-563 in isolated cytochrome b/f complex and in thylakoid membranes. Hind, G.; Clark, R.D.; Houchins, J.P. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 9p. (CONF-8308110—4). NTIS, PC A02/MF A01. Order Number DE83017982.

From 6. international congress on photosynthesis; Brussels, Belgium (1 Aug 1983).

Extensive studies, performed principally by Hauska, Hurt and collaborators, have shown that a cytochrome (cyt) b/f complex isolated from photosynthetic membranes of spinach or Anabaena catalyzes electron transport from plastoquinol (PQH_2) to plastocyanin or algal cyt c-552. The complex from spinach thylakoids generated a membrane potential when reconstituted into liposomes, and although the electrogenic mechanism remains unknown, a key role for cyt b-563 is widely accepted. Electrogenesis by a Q-cycle mechanism requires a plastoquinone (PQ) reductase to be associated with the stromal side of the thylakoid b/f complex though this activity has yet to be demonstrated. It seemed possible that more gentle isolation of the complex might yield a form containing additional polypeptides, perhaps including a PQ reductase or a component involved in returning electrons from reduced ferredoxin to the complex in cyclic electron flow. Optimization of the isolation of cyt b/f complex for Hybrid 424 spinach from a growth room was also required. The procedure we devised is compared to the protocol of Hurt and Hauska (1982). 13 references.

56383 (INIS-mf—8512) Studies of the distribution of intrathecally injected ^{125}I-tetanus antitoxin-F(ab')$_2$. Hanauske, A.R. (Medizinische Hochschule Hannover (Germany, F.R.)). 26 May 1981. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703486.

Diss. (M.D.).

Overall F(ab')$_2$ and antitetanus-f(ab')$_2$ - fragments were labelled with ^{125}I and injected i.th. into normal juvenile cats and adult rats. One group of rats was normal; in the other, unilateral local tetanus had been induced by injection of tetanus toxin into a M. gastrocnemius. The animals were sacrificed 24 h after the i.th. injection, and tissue samples were taken for histoautoradiography. ^{125}I-antitetanus-F(ab')$_2$ permeated into the extracellular space of the spinal cord, roots, and ganglia but not into the neuronal intracellular space. ^{125}I-overall-F(ab') showed identical permeation behaviour. ^{125}I-antitetanus-F(ab')$_2$ reacted with tetanus toxin issuing from the motoneurons after i.th. injection, forming an immunocomplex around the motorneurons. The immunocomplex was not formed around pseudo-unipolar ganglian cells in the spinal ganglia even though some of the ganglian cells contained tetanus toxin, and ^{125}I-antitetanus-F(ab')$_2$ was present in the extracellular space. As an explanation, it was suggested that tetanus toxin does not permeate into the extracellular space through the membrane of the pseudo-unipolar ganglian cells so that immune reactions will not occur. These findings help to explain the widely divergent results of tetanus therapy by means of i.th. injection of tetanus antitoxin. Recommendations for future therapy measures are derived from the findings. (orig./MG).

5506 Medicine

REFER ALSO TO CITATION(S) 56182, 56185, 56276, 56456

56384 (BNL—33679) Analysis of PETT images in psychiatric disorders. Brodie, J.D.; Gomez-Mont, F.; Volkow, N.D.; Corona, J.F.; Wolf, A.P.; Wolkin, A.; Russell, J.A.G.; Christman, D.; Jaeger, J. (New York Univ., NY (USA). Medical Center; IBM de Mexico S.A., Mexico City. Research Center; Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 19p. (CONF-8305109—2). NTIS, PC A02/MF A01. Order Number DE83018299.

From 7. Nobel conference on positron emission tomography; Stockholm, Sweden (17 May 1983).

A quantitative method is presented for studying the pattern of metabolic activity in a set of Positron Emission Transaxial Tomography (PETT) images. Using complex Fourier coefficients as a feature vector for each image, cluster, principal components, and discriminant function analyses are used to empirically describe metabolic differences between control subjects and patients with DSM III diagnosis for schizophrenia or endogenous depression. We also present data on the effects of neuroleptic treatment on the local cerebral metabolic rate of glucose utilization (LCMRGI) in a group of chronic schizophrenics using the region of interest approach. 15 references, 4 figures, 3 tables.

56385 (EHD—81-77) Guidelines for radiopharmaceutical quality control in hospitals. Welsh, W.J. (Department of National Health and Welfare, Ottawa, Ontario (Canada)). 1982. 27p. (In English, French). (EHD—82-77). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703427.

This document has been prepared to assist hospital administrators in ensuring that adequate quality control is performed on radiopharmaceuticals administered to their patients. Three sets of guidelines are presented, the degree of sophistication being dependent on the amount of hospital involvement in the radiopharmaceutical preparation.

56386 (INIS-mf—8560, pp vp) **Scintigraphic phase dynamic studies of fast periodic processes with high time resolution.** Ullmann, V. (Krajska Nemocnice s Poliklinikou, Ostrava (Czechoslovakia)); Dubroka, L.; Kuba, J.; Kuchar, O.; Husak, V. (Fakultni Nemocnice, Olomouc (Czechoslovakia). Oddeleni Nuklearni Mediciny). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8108164—Pt.1-Vol.2).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

Published in summary form only.

56387 (INIS-mf—8560, pp vp) **Determination of spectra of high energy neutron beams for radiotherapeutic applications.** Hrabovcova, A.; Nikodemova, D.; Galan, P. (Vyzkumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)). 1981. (In Slovak). NTIS (US Sales Only), PC A03/MF A01. (CONF-8108164—Pt.1-Vol.2).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

Published in summary form only.

56388 (INIS-SU—179, pp 41-43) **Hormonal activity of thyroid in children-oligopherens, living in endemic goiter region of medium intensity.** Gol'tseva, T.A.; Dolgov, A.G.; Milenevskij, V.S. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrica and infantine surgery. Collection of scientific proceedings.

106 children with oligophrenia from a region of strumous endemia in Upland Shoria were examined clinically and by radioisotope methods in order to reveal thyroid function disorders. The investigation proved the necessity of more detailed examination of children, living in strumous endemia region. The revealed deviations in thyroid hormonal function were the least among abori-

gens. The fact testifies the conclusions that aborigens have certain adaptation mechanisms.

56389 (INIS-SU—179, pp 71-75) **Diagnostic importance of liver scanning in children with malignant tumours.** Semenov, V.N.; Golovkina, N.M.; Konovalov, B.I.; Romantsova, L.A.; Silinskaya, N.V. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

The analysis of liver scanning results in 61 children is given. Malignant neoplasms of liver were found in 5 patients aged from 5 months to 2 years. Examples of scannogram analysis and clinical observations are given. Prognostic and diagnostic value of some tests defined during liver scanning is considered.

56390 (INIS-SU—179, pp 82-84) **Significance of radioisotope renography in diagnostics of abdominal and kidney neoplasms in children.** Malikov, A.A.; Konovalov, B.I.; Shojkhetman, Yu.D. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

The advantages of radioisotope renography are considered. 78 radioisotope investigations of kidney function in 72 children aged from 1.5 to 15 are carried out. The diagnosis was testified in 5 from 15 children with suspicion of kidney neoplasm. Examples of clinical data analysis and liver renograms of patients are given. A conclusion is drawn on the possibility of wide application of the given method in diagnostics of abdomen and retroperitoneal area in children.

56391 (INIS-SU—179, pp 37-40) **Radioisotope diagnostics of thyroid diseases in children.** Atamanov, Yu.A.; Bem, L.T.; Kolosova, G.A. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

Portions are illegible in microfiche products tab.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

A diagnostic method of thyroid scanning using sup(99m)Tc pertechnetate was tried in 54 children from 5 to 15 years old. It was established that the method makes it possible to estimate the organ's characteristics, and together with clinical and laboratory data to diagnose correctly. Radioimmunological definition of triiodothyronine hormones (T_3) and common thyroxine (T_4) showed comparatively low diagnostic value of that method. A conclusion is drawn on the necessity of further working out and study on radioisotope investigation of thyroid function.

56392 (INIS-SU—179, pp 20-23) **Diagnostics of volumetrical intracranial neoplasms of non-tumoral origin in children.** Semenov, V.N.; Gordeev, S.M.; Tarabrin, V.I.; Savin, A.N. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

36 children with intracranial sizeable benign tumors have been examined by means of traditional and radioisotope methods of diagnostics which permits to analyze and compare capabilities of these methods. Advantages of diagnostic radioisotope methods, which are safe and permit to reduce investigational periods, have been revealed. No side effects and complications during the isotope method application were observed. Data on pathology and techniques of special examination in the intracranial sizeable processes in children are given.

56393 (INIS-SU—179, pp 24-25) **Study on liquidynamics by means of radioisotope methods in children with hydrocephalus, attendant to brain and bone marrow ruptures.** Shutov, A.M. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

185 children with hydrocephaly accompanying meningoceles and myelomeningoceles have been examined. Known methods (liquordynamical and resonance samples, pneumoencephalo- and pneumoventriculography) were used during the examination; radioisotope methods were applied in 54 cases. Analysis of radioisotope investigations in comparison with traditional ones has shown their sufficient information capacity; side effects were not observed. Examination period was reduced considerably.

56394 (INIS-SU—179, pp 76-78) **Significance of hepatoscanning in diagnostics of liver diffuse processes in children.** Chirkin, N.I.; Dolgov, A.G.; Fokin, A.P.; Stroganova, L.I. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Results of scanning of children with cirrhosis (44 persons) and hepatitis (50 persons) using ^{198}Au, ^{111}In, sup(113m)In are presented. It is established that the method of radioisotope hepatoscanning in diagnostics of deseases of hepatabiliary system in children has rather significant diagnostic value: liver cirrhosis was confirmed in 70 % of the children examined, hepatitis - in 76 %. Use of colloid sup(113m)In is the most successful as radiation burden on critical organ and the whole organism is very small.

56395 (INIS-SU—179, pp 3-9) **Possibilities of radioisotope investigation methods in diagnosis of children diseases.** Burdin, N.N.; Semenov, V.N.; Dolgov, A.G. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

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In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Experience of radioisotopic methods application to diagnostics of some children diseases in Kemerovo infantine hospital departments has been generalized. Methods of radioisotope diagnostics "in vivo" and "in vitro" as well as areas of their application are discussed in detail. Given are data on radiation burden on critical organs when intaking radiopharmaceutic preparations by children.

56396 (INIS-SU—179, pp 10-19) **Place and significance of radioisotope methods in special clinical investigation in children with hydrocephaly.** Semenov, V.N.; Gordeev, S.M.; Shutov, A.M. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

Paper copy only, copy does not permit microfiche production figs.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Analysis of results of radioisotopic methods of special diagnostics in 162 children with hydrocephaly has shown their high information capacity and in some cases also a higher accuracy as compared with traditional methods as intaking an isotope to liquor or blood is not accompanied with side effects and disturbance of natural liquordynamics.

56397 (INIS-SU—179, pp 30-33) **Cerebral blood circulation from data of radiocirculography in some diseases of central nervous system in children.** Dolgov, A.G.; Stroganova, L.I.; Chirkin, N.I. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Results of radioisotope investigation of cerebral blood circulation in 202 children with different pathology of central nervous system are presented. Velocity of cerebral blood flow and time of semiaccumulation and semimoving a preparate were investigated by means of sup(113m)In. It is established that radiocirculography shows clearly the changes in the system of cerebral blood supply and in such diseases as vegetovascular distonia and hypertension syndrome, the radiocirculography data pass ahead the clinical picture.

56398 (INIS-SU—179, pp 34-36) **Radioisotope investigation into otorhinolaryngological and oral cavity neoplasms in children.** Chuvistov, M.E. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Results of radioisotope investigations in 7 children of 4-15 years old suffering from tumor affections of otorhinolaryngological organs and oral cavity are presented. In all the cases the radioisotope investigation will permit to diagnose correctly with successive confirmation of clinical observations.

56399 (INIS-SU—179, pp 44-46) **Regional ventilation and pulmonary blood circulation in healthy children.** Davydov, B.I.; Alekseeva, A.P.; Smirnova, A.A.; Torochkina, G.P.; Perevoshchikova, N.K. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Physiological parameters of respiration of each lung and and its lobes have been examined in 30 children of school age. Regional ventilation was studied by the method of intaking xenon-133 (total activity of up to 37×10^4 Bq) through inhalation tracts, regional lung blood flow - by means of intravenous injection of physiological solution of 18.5×10^4 Bq total activity. It is established that volumetric capabilities of right lung of healthy children are more considerable as compared with symmetrical sections on the left. The data obtained promote studies of pathogenesis of pneumonias and their treatment in children in the first place living in regions with intensively polluted air with gaseous products.

56400 (INIS-SU—179, pp 47-50) **Radiopneumographic characteristics of focal pneumonia in children.** Smirnova, A.A. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

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In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Zonal ventilation and blood flow were studied by the radiopneumography method in 50 children of school age with lower-lobe-of-the lung focal pneumonia (26 with left-side and 24 with right-side). It is established that during right-side localization of pneumonic focus preserved was the predomination of ventilation of right lung relative to left. Complete normalization of common and regional indexes of ventilation and blood flow was established by the 21st day from the beginning of treatment during right-side focal pneumonias. In case of left-side localization of pneumonic focus only partial reduction of external respiration and perfusion comes. Therefore, compensatory and reducing capabilities of right lung are preferrable.

56401 (INIS-SU—179, pp 51-55) **Function of external respiration in children with chronic pneumonia.** Davydov, B.I.; Alekseeva, A.P.; Perevoshchikova, N.K. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

Microfiche only, copy does not permit paper copy reproduction tabs.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Study of regional ventilation and blood flow using xenon-133 radioactive gas permits to refine the degree of participation of each lung and its lobes in the general system of external respiration. For this purpose 28 children of school age with chronical pneumonia have been examined. The examination was carried out both exacerbation phase and remission of disease. Reduction of alveoli ventilation volume and moderation of moving gas predominantly from left lung is established. Disturbance of arterial blood flow was mostly marked in lower and middle lobes of both lungs.

56402 (INIS-SU—179, pp 62-65) **Radioisotope investigations in diagnostics of bronchial pathology during chronic pneumonia in children.** Goncharenko, V.N.; Fokin, A.P. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Inhalation scanning of lungs by means of radioaerosol of colloidal sup(113m)In and was carried out in 31 children of 3-14 years old with chronical pneumonia. No complications during and after inhalation scanning of lungs among children were observed. Considering that in the development of chronical aspecific pneumonia bronchitis plays a leading role, during analysis of the data obtained the scannogram data were compared with clinical-roentgenological, endoscopic and bronchographical pictures of the bronchopulmonary system. It is established that the method of inhalation scanning gives true data on disturbances of bronchial patency and lung ventilation. Its broader introduction into pediatric practice is recommended.

56403 (INIS-SU—179, pp 66-68) **Radioisotope investigation in portal hemodynamics in diagnostics of surgical liver diseases in children.** Vorontsov, Yu.P.; Dmitrienkov, B.N.; Andronov, S.V.; Alferov, G.A. (Vtoroj Moskovskij Gosudarstvennyj Meditsinskij Inst. (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Method of dynamic gamma scintiscanning With ^{133}Xe solution intaken rectally has been developed and used to investigate portal hemodynamics in 116 children with different liver pathology. Further investigations have proved high informative capacity of the portal hemodynamics analysis by means of introduction of radioxenon in surgical diseases of liver in children. Diagnostic efficiency alongside with absolute noninvasiveness and insignificant radiation burden permit to recommend it for wide introduction into modern radioisotope diagnostics.

56404 (INIS-SU—179, pp 69-70) **Radioisotope investigations on portal hypertension syndrome in children.** Karkashin, V.N.; Vorob'ev, A.M. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

To study cardioportal blood flow in 21 children with syndrome of portal hypertension, radioportography and intraspleen radioportography investigations were carried on. As one of the disadvantages of intravenous radioportography is dependence of this index on the state of the cardiovascular system as a whole, in some cases the intraspleen radioportography with ^{131}I hippuran was performed additionally. Advantage of this method is that it permits to determine the whole portal blood flow spleen to liver and simultaneously to reveal the presence of collateral blood flow which significantly adds and facilitates differential diagnostics of cirrhosis, chronical hepatitis and syndrome of extrahepatic portal hypertension.

56405 **Radionuclide angiocardiography. An improved deconvolution technique for improvement after suboptimal bolus injection: experimental results in dogs with and without atrial septal defects.** Kuruc, A. (Harvard Medical School, Boston, MA); Treves, S.; Parker, J.A.; Cheng, C.; Sawan, A. *Radiology;* **148**: No. 1, 233-238(Jul 1983).

Deconvolution is a mathematical technique used to improve radionuclide angiocardiography after suboptimal injection of radiopharmaceutical. A new deconvolution algorithm designed to be relatively insensitive to the random errors that occur in experimental data was tested. First-pass radionuclide angiocardiography using iridium-191m was performed to quantitate left-to-right shunting in normal dogs and dogs with atrial septal defects. Deconvolution was used to correct for injection shape. Four quantitation techniques were studied (good injection/no deconvolution, good injection/deconvolution, fragmented injection/no deconvolution, fragmented injection/ deconvolution). This deconvolution method made it possible to accurately quantitate left-to-right shunts even with fragmented injections.

56406 **Work in progress: californnium-252 brachytherapy plus fractionated irradiation for advanced tonsillar carcinoma.** Maruyama, Y. (Univ. of Kentucky, Lexington). *Radiology;* **148**: No. 1, 247-251(Jul 1983).

A feasibility trial of californium-252 neutron brachytherapy combined with fractionated cobalt-60 therapy for advanced but localized stage T4 tonsillar-retromolar carcinoma is described. Seven patients with primary tumors who were not suitable for conventional radical surgery, chemoradiotherapy and surgery, or surgery plus irradiation were treated. There was complete tumor response in all cases.

56407 **Screening for asymptomatic coronary artery disease.** Uhl, G.S.; Froelicher, V. (Department of Cardiology, Lovelace Medical Center, Albuquerque, New Mexico). *Journal of the American College of Cardiology;* 1: No. 3, 946-955(Mar 1983).

Because it will be some time before the primary prevention of cardiovascular disease is a reality, it is advisable to evaluate screening methods for detecting latent cardiovascular disease. Because risk factor screening and techniques with the patient at rest have limited sensitivity, exercise testing that brings out abnormalities not present at rest deserves consideration. Numerous studies have shown the exercise electrocardiogram to have a sensitivity of approximately 50% and a specificity of 90%. The different reported predictive values are related to its use in populations with different prevalences of disease. Various techniques have been recommended to improve the sensitivity and specificity of exercise testing, including other exercise measurements, computerized probability estimates, nuclear cardiology, cardiokymography, cardiac fluoroscopy and risk factor analysis. There is promise that these techniques will improve attempts to screen asymptomatic subjects for coronary disease.

56408 **Radiomanganese for positron emission tomography: a comparative study with ^{201}Tl-chloride.** Som, P.; Oster, Z.H.; Lewis, W.; Fairchild, R.G.; Atkins, H.L. (Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Stony Brook (USA)). *Nuclear Medicine Communications;* 4: No. 1, 8-16(Feb 1983).

A comparative study was made of the biodistribution patterns of two myocardial imaging agents, ^{201}Tl chloride and radiomanganese, in mice. Blood and tissue samples were collected for up to 24 hours after intravenous injection. It was concluded that Sup(52m)Mn has advantages over ^{201}Tl as a myocardial imaging agent because of its faster blood clearance and lower concentration in adjacent organs. sup(52m)Mn is suitable for myocardial imaging by positron emission tomography.

56409 **Treatment of carcinoma of the cervix at the Academic Hospital in Groningen from 1970 to 1979.** Timmer, P.R. Groningen, Netherlands; Rijksuniversiteit (1982). 197p. (In Dutch). Available from University Library, Oude Kijk in 't Jatstraat 5, 9712 EA Groningen (NL).

This dissertation is a study concerning the treatment and corresponding results of 332 patients with an invasive cervical carcinoma. The purpose of this investigation is to gain insight into the efficacy of the treatment used and, if necessary, to suggest guidelines for its improvement. In chapter I, a historical overview is given of both treatment modalities, radiotherapy and surgery, which are used in patients with cervical carcinoma. A discussion of the advantages and disadvantages of both methods follows. In chapter II, an overview is given of the composition of the group of patients studied. A systematic overview of the treatment methods is given, followed by a discussion of the items covered in this study. In chapter III, in which the combined modality treatment is discussed, a detailed consideration is given of the motivation for using a combination of radiotherapy and surgery. In chapter IV, the group of patients treated exclusively by radiotherapy is considered. In chapter V, attention is focused on the localisation of the recurrences and the relationship of this localisation with regard to the target area of the primary treatment. In chapter VI there is a discussion of the complications of treatment. In the combined modality treatment, most complications appear to occur as a result of the surgical treatment. The final chapter contains the conclusions and discussions.

56410 **Studies on growth hormone: characterization of radiolodinated hormone and of receptors.** Cadman, H.F. Brighton, England; Sussex University (1981). 192p. Available from British Library, Boston Spa, Wetherby, West Yorks. No. D42665/82.

Human growth hormone (hGH) has been prepared and characterised to a high specific activity with ^{125}I suitable for use in competitive binding assays. The suitability of various methods for labelling hGH for use in radioimmuno - and radioreceptor assays is assessed. An investigation of the specificity of hGH receptors in the liver and mammary gland of pregnant rabbit is described and the effect of solubilisation on the specificity and affinity of membrane-band receptors from these areas is assessed. The ability of antibody-bound hGH to react with membrane-bound receptors from rabbit liver and mammary gland was investigated.

56411 **Liver, biliary tract and gall bladder: Nuclear medical examinations and their performance.** Karlsruhe, Germany, F.R.; Fachinformationszentrum Energie, Physik, Mathematik ([nd]). 12p. (In German). Available from Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

There are two frequently applied nuclear medical examinations for liver, biliary tract and gall blader: the so-called 'static' liver scintigram and the hepatobiliary sequential scintigram. In addition, some other methods for liver scintiscanning exist, which are performed only in rare cases. These techniques are described in detail.

5507 Microbiology

REFER ALSO TO CITATION(S) 55573

56412 **(LBL—16626) Structural analysis of the surface-layer protein of Aquaspirillium serpens by high-resolution electron microscopy.** Wu, W.H. (Lawrence Berkeley Lab., CA (USA)). Jul 1983. Contract AC03-76SF00098. 163p. NTIS, PC A08/MF A01. Order Number DE84001287.

Thesis.

Aquaspirillum serpens possesses a surface layer protein exhibiting a regular hexagonal packing of the morphological subunits (HP-protein). A method was developed to isolate large quantities of outer wall fragments of Aquaspirillum serpens. Two models for crystal formation were presented in this thesis. Low dose, low temperature electron microscopy were applied to the frozen hydrated specimens of HP-protein. Computer image processing was applied to selected areas of micrographs. Statistical analysis showed the existence of peaks above a local background. For those peaks identified, the adjusted phases were determined to be close to 0 or 180. A computer processed image of the frozen hydrated specimen was obtained with a resolution of 13.70 A. Structural details at 6.9 A were preserved and were retrieved in the image of the frozen hydrated specimen. A method was developed where the specimen was negatively stained, air dried, frozen in liquid nitrogen, and transferred to the high resolution cold stage (NSFT). A computer processed image with a resolution of 13.70 A was obtained for the specimen prepared by the NSFT method. Structural details at 5.7 A were preserved and retrieved in the image of the specimen prepared by the NSFT method. The computer processed images for the two methods appear to be fairly different. In the NSFT method both protein and stain seem to contribute image contrast making interpretation difficult. An advantage of the NSFT method is ease with which high quality micrographs can be taken.

5510 Physiological Systems

56413 **(LBL—16642) Quantum effects in the dynamics of biological systems.** Bialek, W.S. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 262p. NTIS, PC A12/MF A01. Order Number DE84000958.

Thesis. Submitted to the Univ. of California, Berkeley.

The performance of biological sensory systems is shown to reach the quantum limits to measurement, this being true in spite of the high levels of thermal noise associated with operation at phisiological temperatures. Theoretical issues associated with quantum-limited measurement at high temperatures are addressed and strategies for such measurements which make use of active filtering are formulated. Experimental and theoretical evidence supporting the existence of active filters in the sensors of the inner ear is discussed. Simple model Hamiltonians are formulated which seem to describe the dynamics of biological molecules and field-theoretic techniques are developed to solve these Hamiltonians in a variety of parameter regimes. Conditions for non-trivial quantum effects in these models are compared with experiments on the primary events of photosynthesis and the low-temperature behavior of heme proteins. Predict-

ed quantum effects are observed and independent observations support the assignment of parameters outside the regime where semiclassical approximations are valid. In each case considered, theoretical analysis demonstrates that quantum effects in biology are significant if not dominant, and this leads to fundamentally new interpretations of several biological processes. Detailed experiments are proposed which will provide quantitative tests of these new interpretations.

56414 (LMF—102, pp 450-453) **Relationship of driving pressure to sensitivity of forced expiratory tests to emphysema in rats.** Mauderly, J.L. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Respiratory function tests were performed on rats before and after intratracheal instillation of elastase or saline. Forced expiration was done using lung inflation pressures of either +15 or 30 cm H_2O and expiratory driving pressures of -20, 40, 50, 60 or 80 cm H_2O. Elastase induced mild but significant alterations in lung function and morphometry consistent with the presence of emphysema. Partial lung inflation did not improve the sensitivity of the forced expiration tests. Greater expiratory driving pressures tended to increase the sensitivity of indices measured at high lung volumes and less negative pressures tended to yield greater sensitivity at low lung volumes; however, differences related to driving pressure were not significant and all pressures yielded adequate sensitivity.

56415 (LMF—102, pp 454-459) **Determination and partial characterization of the endogenous proteinolytic activity present in the rat lung.** Gregory, R.E.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Release of ^{14}C-peptides from a labeled globin substrate was used to measure lung tissue proteinolytic activity. Purified carboxy-, thiol- and serine proteinases were active against this substrate. The lung activity was partially characterized by the use of specific proteinase inhibitors or activators. The majority of the endogenous proteinolytic activity of normal rat lungs was seen only at an acid pH. Proteinase activity at the acid pH could be ascribed to cathepsin D- and B-like proteinases. The small amount of activity at the higher pHs was due to plasmin, tryptic- and elastase-like proteinases. This activity was also susceptible to activation by bacterial exopeptidases, suggesting the presence of a proproteinases in normal rat lung tissue. These results indicate that this proteinase assay could be used as an indicator of lung damage and a predictor of developing chronic lung injury in the rat.

56416 (LMF—102, pp 460-462) **Tests for cellular immunity in the dog lung.** Galvin, J.B.; Bice, D.E.; Muggenburg, B.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

We developed a new test to examine cell-mediated immunity (CMI) in the dog lung. Leukocyte procoagulant activity was compared to a well-characterized test, macrophage migration inhibition (MIF) assay, to evaluate the CMI response after immunization with a T-cell-dependent antigen sheep red blood cells. The new assay correlated well with the MIF assay and gave a maximal response at similar times.

56417 (LMF—102, pp 463-466) **Immune responses after lung immunization of aged dogs.** Bice, D.E.; Muggenburg, B.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Dogs from 5 through 16 years of age were immunized by deposition of antigen in a single lung lobe. The number of lymphoid cells producing specific antibody and the level of specific IgG antibody were measured in blood as well as in the immunized and control lung lobes. Most dogs over 9 years of age had significantly lower numbers of antibody-forming cells and specific IgG antibody in the immunized lung lobe than observed in younger dogs. Even though antibody-forming cells and specific antibody were in the blood of low responding animals, mechanisms necessary to recruit immune cells and antibody from the blood into the lung appeared to be defective in the low responding dogs.

56418 (LMF—102, pp 467-472) **Immune responses in rabbits after parenteral or lung immunization.** Bice, D.E.; Muggenburg, B.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The deposition of particulate antigen in the lung of rabbits induced a large number of specific IgM antibody-forming cells in the thoracic lymph nodes. Increased numbers of antibody-forming cells were also found in the blood, and some antibody-forming cells were recruited to the lung. However, a similar low number of antibody-forming cells was found in the control and immunized lungs of rabbits. Although the rabbit had antibody-forming cells in the blood, changes were apparently not produced in the immunized lung that allowed the entry of a large number of immune cells from the blood into the alveoli.

5520 Public Health

REFER ALSO TO CITATION(S) 56331

5530 Agriculture And Food Technology

56419 (CONF-8107113—1-Summ.) **^{14}C - metalaxyl translocation in soybean (Glycine max L.).** Musumeci, M.R.; Ruegg, E.F.; Campacci, C.A. (Instituto Biologico, Sao Paulo (Brazil). Centro de Radioisotopos). (Instituto Biologico, Sao Paulo (Brazil). Centro de Radioisotopos). 1981. 162p. (In Portuguese). Copies available from CIN, Brazil.

From 15. congress of the Brazilian Society of Phytopathology; Porto Alegre, Brazil (13 Jul 1981).

Published in summary form only.

56420 (IAEA-TECDOC—270) **Use of nuclear techniques in improving fertilizer and water management practices for tree crops. Proceedings of a consultants meeting organized by the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development held in Vienna, 9-13 November 1981.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). 1982. 117p. (CONF-8111163—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780006.

From Meeting on the use of nuclear techniques in improving fertilizer and water management techniques for tree crops; Vienna, Austria (9 Nov 1981).

Items within the scope of EDB have been entered individually into the data base. (ACR)

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 55548, 55549, 56311, 56331, 56332, 56408, 56494

56421 (AD-A—128035/3) **Project Trinity, 1945-1946. Final report.** Maag, C.; Rohrer, S. (JRB Associates, Inc., McLean, VA (USA)). 15 Dec 1982. 76p. NTIS, PC A05/MF A01.

This report describes the activities of an estimated 1,000 personnel, both military and civilian, in Project TRINITY, which culminated in detonation of the first nuclear device, in New Mexico in 1945. Scientific and diagnostic experiments to evaluate the effects of the nuclear device were the primary activities engaging military personnel.

56422 (BNL—33598) **Micropixe as a tool to search for uranium-bearing particles in lung tissues.** Paschoa, A.S.; Wrenn, S.C.; Miller, M.E.; Jones, K.W.; Cholewa, M.; Hanson, A.L. (Utah Univ., Salt Lake City (USA). Dept. of Pharmacology; Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 6p. (CONF-8210106—6). NTIS, PC A02/MF A01. Order Number DE83018278.

From Workshop on uses of nuclear analytical methods in metal toxicology; Upton, NY, USA (11 Oct 1982).

A proton microbeam is proposed as a tool to search for uranium-bearing particles in lung tissues. Preliminary experiments have been undertaken by irradiating with protons lung tissues of dogs previously exposed to uranium ore. 7 references.

56423 (DOE/EV/04472—T2) **Relationship of DNA repair processes to mutagenesis and carcinogenesis in mammalian cells. Progress report, October 1, 1982-September 30, 1983.** Evans, H.H. (Case Western Reserve Univ., Cleveland, OH (USA)). 30 Sep 1983. Contract AC02-77EV04472. 18p. NTIS, PC A02/MF A01. Order Number DE84000858.

Two strains of murine L5178Y lymphoma cells have been characterized as to their sensitivity to the lethal and mutagenic effects of ionizing radiation, delivered at either high (53 Gy/hr) or low (0.02 Gy/hr) dose rates. Both strains were less sensitive to the lethal effects of low dose-rate radiation than high dose-rate radiation, but the differences was much greater in the case of strain LY-R. Strain LY-R was also less sensitive to the mutagenic effects of low dose-rate radiation than high dose-rate radiation, but the dose-rate dependence was much less than in the case of the lethal effects. In the case of strain LY-S, a higher mutation frequency was obtained at the low dose rate than at the high dose rate. Although strain LY-S was more sensitive to the lethal effects of ionizing radiation, it was more poorly mutable following treatment with alkylating agents and UV radiation. We suggest that strain LY-S may be deficient in an error-prone repair process. Comparison of the DNA repair capabilities of the two strains has revealed that the rejoining to the hypersensitivity of strain LY-S to the lethal effects of ionizing radiation is under investigation.

56424 (INIS-mf—8494) **Effects and control of radiation.** Saunders, P.A.H. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Dec 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703487.

The subject is discussed under the headings: introduction; ionising radiation (alpha and beta particles, gamma- and X-radiation, neutrons, half-life, sources of radiation); biological effects; risk estimates (somatic) (early effects, delayed effects); risk estimates (hereditary); control of radiation; risk estimates (accidents). (U.K.).

56425 (INIS-mf—8528) **Mutants of alfalfa mosaic virus.** Roosien, J. (Rijksuniversiteit Leiden (Netherlands)). 1983. 149p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83703485.

Thesis.

In this thesis the isolation and characterization of a number of mutants of alfalfa mosaic virus, a plant virus with a coat protein dependent genome, is described. Thermo-sensitive (ts) mutants were selected since, at least theoretically, ts mutations can be present in all virus coded functions. It was found that a high percentage of spontaneous mutants, isolated because of their aberrant symptoms, were ts. The majority of these isolates could grow at the non-permissive temperature in the presence of a single wild type (wt) component. To increase the mutation rate virus preparations were treated with several mutagens. After nitrous acid treatment or irradiation with ultraviolet light, an increase in the level of mutations was observed. UV irradiation was preferred since it did not require large amounts of purified viral components. During the preliminary characterization of potential ts mutants the author also obtained one structural and several symptom mutants which were analysed further (chapter 7, 8 and 9). The properties of the ts mutants are described in chapter 3-7.

56426 (INIS-mf—8560, pp vp) **Double-strand breaks of DNA molecules and inactivation mechanism of ionizing particles.** Lokajicek, M. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav); Prokes, K. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Pridal, I. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8108164—Pt.1-Vol.2).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

Published in summary form only.

56427 (LMF—102, pp 145-147) **Induction of chromosome aberrations in dividing and confluent rat lung epithelial cells by acute ^{60}Co gamma ray exposure.** Brooks, A.L.; Li, A.P.; Dziengelewski, H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A lung epithelial cell line isolated from a male Fischer-344 rat was exposed to 0.0, 0.5, 1.0, 2.0, 4.0 or 8.0 grays of gamma radiation with a ^{60}Co source while they were rapidly proliferating or confluent. No chromatid exchanges and only three chromatid-type aberrations were observed in first division cells of the confluent cultures, indicating that most of the cells were in the G_1 or G_0 stages of the cell cycle at the time of exposure. Chromatid- and chromosome-type aberrations were observed in the first division cells of proliferating cell cultures. The coefficient in aberrations production (aberrations/cell/gray) was 0.32 +- 0.02 (mean +- SD) for the proliferating cells and 0.48 +- 0.03 for the confluent cells. The aberration frequency in this cell line was not dependent on stage of the cell cycle and was similar to what has been observed in other cell types.

56428 (LMF—102, pp 199-201) **Microscopic dose distribution around PuO_2 particles in lungs of hamsters, rats and dogs.** Diel, J.H.; Mewhinney, J.A.; Guilmette, R.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Syrian hamsters, Fischer-344 rats and Beagle dogs inhaled monodisperse aerosols of PuO_2 and were sacrificed 1 to 16 days after exposure. The microscopic distribution of dose and tissue-at-risk around individual particles in lung was studied using autoradiographs of the lungs. The dose pattern in dogs and rats was more diffuse than in hamsters, resulting in a calculation of about twice the tumor incidence in rats and dogs as in hamsters on the basis of dose pattern using the same dose-effect model for all three species. The tumorigenic effect of inhaled insoluble PuO_2 particles depends on the species inhaling the material; Syrian hamsters are much less susceptible than are rats or dogs. It has been suggested that a difference in dose distribution resulting from differences in particle distributions in the two species may contribute to the differences in susceptibility in Syrian hamsters and rats. The role of dose distribution in lung cancer production is explored in this study by measuring microscopic dose patterns in regions surrounding single PuO_2 particles in lung. The alveolar structures of the dog and rat are different than those of the hamster. Based on these measurements, particles of PuO_2 in lung are more likely to cause lung cancer in dogs and rats than in hamsters.

56429 (LMF—102, pp 202-205) **Retention, distribution and dosimetry of inhaled $^{239}PuO_2$ particles in Beagle dogs.** Guilmette, R.A.; Diel, J.H.; Mewhinney, J.A.; Muggenburg, B.A.; Boecker, B.B. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The temporal patterns of radiation dose to tissues of Beagle dogs which have inhaled $^{239}PuO_2$ aerosols are being studied. Dogs received single nose-only inhalation exposures to monodisperse or polydisperse aerosols and have been sacrificed from 4 hours through 4 years after exposure. The long-term retention of ^{239}Pu in lung continues to be persistent, with 26% of the initial lung burden (ILB) present in lung at 4 years for the dogs receiving the 0.72 μm activity median aerodynamic (AMAD) aerosol, 31% for those receiving the 1.4 μm AMAD aerosol and 43% for those receiving

the 2.8 μm AMAD aerosol. The majority of the remaining amounts of ^{239}Pu measured in the body at 4 years has been found in the thoracic lymph nodes (4 to 22% ILB; average 11% ILB). That the aerosol remains sparingly soluble in vivo, even at 4 years, is evidenced by the low skeletal burdens (<0.7% ILB). Uptake by the liver was somewhat higher (1 to 10% ILB), and was probably related to the transport of intact particles resulting from the higher levels of ^{239}Pu to which the dogs were initially exposed.

56430 (LMF—102, pp 206-208) **Biokinetics of inhaled curium aerosols in Beagle dogs.** Guilmette, R.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

To determine the effect of physicochemical form of inhaled curium aerosols on subsequent retention, translocation, distribution and excretion young adult Beagle dogs received or will receive single inhalation exposures to one of the following aerosols: monodisperse 1.5 μm activity median aerodynamic diameter (AMAD) particles of Cm_2O_3, CmO_2 of Cm_7O_{12}, or polydisperse 1.5 μm AMAD (with geometric duration approximately 2) particles of $Cm(NO_3)_3$. Through measurement of curium in the tissues of serially sacrificed animals and of collected urine and feces samples, the biokinetics of curium are being elucidated as a function of physical and chemical form of the inhaled aerosols.

56431 (LMF—102, pp 209-211) **Binding of neptunium to serum proteins in vitro.** Guilmette, R.A.; Medinsky, M.A.; Petersen, D.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The biological fate of neptunium compounds has received little study in the past. Moreover, interpretation of the data from past animal studies is also complicated because of the use of large masses of Np and unknown chemical forms. In this study, picogram quantities of well-characterized solutions of ^{239}Np were incubated with canine serum and the resultant mixture characterized by gel chromatography, protein precipitation using trichloroacetic acid, dialysis and ultrafiltration. Results obtained using pure Np(V) solutions indicate that about half of the Np was bound to protein; the proteins to which the Np was bound were either quite large (MW > 300,000 daltons) or quite small (MW < 5000 daltons). Work is continuing to determine the effect of valence and mass on Np-serum interactions.

56432 (LMF—102, pp 221-223) **Deposition and retention of neutron-activated pulverized coal combustor fly ash inhaled by Beagle dogs.** Snipes, M.B. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Beagle dogs were exposed by inhalation to an aerosol of neutron-activated fly ash from a pulverized coal combustor. The radionuclide content of whole body, tissue and excreta is being analyzed to define the fate of the neutron-activated fly ash and its constituents after inhalation exposure. Preliminary results are presented for whole body biological retention of ^{59}Fe and ^{46}Sc, two neutron activation products of the fly ash.

56433 (LMF—102, pp 265-270) **Toxicity studies of inhaled beta-emitting radionuclides: status report.** Hahn, F.F.; McClellan, R.O.; Boecker, B.B.; Hobbs, C.H.; Jones, R.K.; Lundgren, D.L.; Mauderly, J.L.; Muggenburg, B.A.; Pickrell, J.A.; Redman, H.C. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The influence of total dose and dose rate on the effects of inhaled beta-emitting radionuclides is being studied in laboratory animals. The radionuclides are inhaled either in a relatively soluble form ($^{90}SrCl_2$, $^{144}CeCl_3$, $^{91}YCl_3$ or $^{137}CsCl$) or in a relatively insoluble form in fused aluminosilicate particles. The organs affected depend on the solubility and chemical characteristics of the radionuclides. Studies with young adult dogs are complemented with comparable studies in other species (mice, rats and Syrian hamsters) with animals of different ages and animals repeatedly exposed to ^{144}Ce.

56434 (LMF—102, pp 271-275) **Toxicity of inhaled $^{90}SrCl_2$ in Beagle dogs. XVI.** Snipes, M.B.; Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; Jones, R.K. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Beagle dogs were exposed to aerosols containing $^{90}SrCl_2$ to obtain initial body burdens ranging from 2.5 to 250 μCl ^{90}Sr/kg body weight. These dogs were maintained for lifetime observation or assigned to a sacrifice schedule. Dogs have died from a variety of causes related to radiation exposure, including bone marrow aplasia and bone-related neoplasms. During the past few years, most deaths have been due to conditions associated with aging, such as renal insufficiency and a variety of tumors in organs receiving low doses of radiation relative to the skeleton, which is the primary target of radiation exposure for internally-deposited ^{90}Sr. During the past year, the last two dogs in the study were euthanized.

56435 (LMF—102, pp 276-279) **Toxicity of inhaled $^{91}YCl_3$ in Beagle dogs. XVI.** Hahn, F.F.; Muggenburg, B.A.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The metabolism, dosimetry and biological effects of inhaled $^{91}YCl_3$ in Beagle dogs are being studied. Forty-two dogs with initial ^{90}Y body burdens from 14 to 1300 μCi per kilogram body weight and 12 control dogs are being maintained for lifetime observation. Four additional dogs with a mean initial body burden of 180 μCi ^{91}Y per kilogram body weight were placed in a sacrifice study. Forty-four of the exposed dogs and all 12 of the control dogs have died. Dogs with the highest initial body burdens died with bone marrow damage and pancytopenia. Three dogs died with nasal cavity carcinomas, three dogs died with pulmonary carcinomas and one dog died with hepatic hemangiosarcoma; these cancers all appeared to be related to radiation injury. Control dogs died of miscellaneous neoplastic and chronic diseases. Observations are continuing on the two surviving exposed dogs.

56436 (LMF—102, pp 280-283) **Toxicity of inhaled $^{144}CeCl_3$ in Beagle dogs. XV.** Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; McClellan, R.O.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The metabolism, dosimetry and biological effects of inhaled $^{144}CeCl_3$ in Beagle dogs are being studied to assess the consequences of inhaling ^{144}Ce. Studies have shown that ^{144}Ce deposited in lung as $^{144}CeCl_3$ is translocated at a moderately rapid rate to liver and skeleton and that significant radiation doses are accumulated by all three organs. The dogs exposed to ^{144}Ce had long-term retained burdens that ranged from 2.6 to 360 μCi ^{144}Ce/kg body weight. All 55 of the dogs exposed to $^{144}CeCl_3$ and 15 of 17 control dogs have died. There are two surviving control dogs.

56437 (LMF—102, pp 284-288) **Toxicity of injected $^{137}CsCl$ in Beagle dogs. XV.** Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A.; Redman, H.C. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Studies of the metabolism, dosimetry and effects of intravenously administered $^{137}CsCl$ in the Beagle dog are being conducted to aid in assessing the biologic consequences of exposure to ^{137}Cs that might occur in the event of certain nuclear accidents. Effects of the chronic, relatively uniform whole-body exposures produced by ^{137}Cs are being compared with other diverse radiation dose patterns resulting from inhalation of radioactive aerosols. Fifty of the dogs that were injected with $^{137}CsCl$ have died and six control dogs have died; seven exposed dogs died during the past year. Serial observations are continuing on the surviving four $^{137}CsCl$-injected dogs and six control dogs.

56438 (LMF—102, pp 289-294) **Toxicity of ^{90}Y in a relatively insoluble form inhaled by Beagle dogs. XIV.** Hahn, F.F.; Hobbs, C.H.; Kusewitt, D.F.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The metabolism, dosimetry and biological effects of inhaled ^{90}Y in fused aluminosilicate particles in Beagle dogs are being studied. Eighty-nine dogs with initial lung burdens ranging from 80 to 5200 μCi ^{90}Y/kg body weight and 12 control dogs are being maintained for life span observations. The lung burdens achieved, short physical half-life and relative insolubility of the ^{90}Y in this vector resulted in a relatively high, rapidly decreasing radiation dose rate to the lung. To date, 69 exposed dogs have died; 38 from radiation pneumonitis, seven with pulmonary neoplasms and 24 from other causes. Four control dogs have died. Twenty-nine surviving exposed and eight control dogs are being studied for their life spans.

56439 (LMF—102, pp 295-299) **Toxicity of ^{91}Y inhaled in a relatively insoluble form by Beagle dogs. XIII.** Hahn, F.F.; Muggenburg, B.A.; Kusewitt, D.F.; Hobbs, C.H.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Beagle dogs were exposed by inhalation to aerosols of ^{91}Y in fused aluminosilicate particles resulting in initial lung burdens ranging from 11 to 300 μCi ^{91}Y per kilogram body weight. These dogs were maintained for life span observation or assigned to a sacrifice schedule to study radiation dose patterns. Dogs with higher lung burdens died at early times with radiation pneumonitis. At later times, tumors were seen in lung, nasal cavity, heart and tracheobronichial lymph nodes; these organs received the highest radiation doses. Observations are continuing on the 25 exposed and 7 control dogs that remain alive 11 to 12.5 years after exposure.

56440 (LMF—102, pp 300-305) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by Beagle dogs. XV.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The metabolism, dosimetry and effects of ^{144}Ce inhaled in fused aluminosilicate particles are being investigated using Beagle dogs to assess the long-term biological consequences of the release of relatively insoluble aerosol forms of ^{144}Ce that could occur in nuclear accidents. One hundred eleven dogs were exposed to aerosols of ^{144}Ce infused aluminosilicate particles to yield initial lung burdens of 0.0024 to 210 μCi ^{144}Ce/kg body weight and 15 control dogs were exposed to nonradioactive fused aluminosilicate particles. To date, 78 ^{144}Ce-exposed and 5 control dogs have died or were euthanized at 143 to 4759 days after inhalation of ^{144}Ce. Observations are continuing on the 33 ^{144}Ce-exposed and 10 control dogs remaining alive at this time, at least 4067 days (~ 11 years) after exposure.

56441 (LMF—102, pp 306-309) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by immature Beagle dogs. XI.** Boecker, B.B.; Muggenburg, B.A.; Hahn, F.F.; Mauderly, J.L.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Immature Beagle dogs (3 months old) were exposed once by inhalation to an aerosol of ^{144}Ce incorporated in fused aluminosilicate particles to study the effects of age on the dose-response relationships for ^{144}Ce inhaled in a relatively insoluble form. This study uses 49 dogs that received graded initial lung burdens ranging from 0.004 to 140 μCi ^{144}Ce/kg body weight and five control dogs. To date, 18 of the ^{144}Ce-exposed dogs and one of the controls have died. Dogs with the highest initial lung burdens of ^{144}Ce died during the first 4 months with radiation pneumonitis, pulmonary fibrosis and congestive heart failure. Pulmonary hemangiosarcoma was the primary finding in dogs that died at 1.5 to 2 years after exposure. Deaths beyond that time have been due primarily to extrapulmonary hemangiosarcomas. Observations are continuing on the surviving 31 ^{144}Ce-exposed and four control dogs at 6.0 to 10.2 years after exposure.

56442 (LMF—102, pp 310-313) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by aged Beagle dogs. XI.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The toxicity of relatively insoluble ^{144}Ce inhaled by 8- to 10.5-year-old Beagle dogs is being investigated to determine possible age-related differences in long-term biological responses. Forty-two dogs were exposed, nose-only, to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 2.2 to 75 μCi ^{144}Ce/kg body weight, and 12 control dogs were exposed to nonradioactive fused aluminosilicate particles. To date, 41 ^{144}Ce-exposed dogs and 11 control dogs have died or were euthanized between 197 and 2509 days after the inhalation exposure. Prominent findings in the ^{144}Ce-exposed dogs were radiation pneumonitis in 19 of the 23 dogs that died during the first 943 days after exposure and neoplastic disease in 10 of the 18 dogs that died beyond 943 days after exposure. Pulmonary tumors were found in five of these dogs. Observations are continuing on one surviving ^{144}Ce-exposed and one control dog.

56443 (LMF—102, pp 314-318) **Toxicity of ^{90}Sr inhaled in a relatively insoluble form by Beagle dogs. XIII.** Snipes, M.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Beagle dogs were exposed by inhalation to ^{90}Sr in a relatively insoluble form to study long-term health effects. Lung burdens ranged from 0.02 to 96 μCi of ^{90}Sr per kilogram of body weight. High levels of exposure resulted in radiation pneumonitis and pulmonary fibrosis; lower level exposures caused long-term effects which included cancer of the lung, heart and tracheobronchial lymph nodes. Most of these tumors were hemangiosarcomas. Three control dogs and two ^{90}Sr-exposed dogs died or were euthanized during the past year. One exposed dog died with hemangiosarcoma of the liver; the other exposed dog died with hemangiosarcoma of the tracheobronchial lymph nodes. One control dog died during routine anesthesia, one died with hepatocellular carcinoma and the third died with transitional cell carcinoma of the bladder.

56444 (LMF—102, pp 319-321) **Early lethality in Beagle dogs for ^{90}Sr inhaled in a relatively insoluble form.** Snipes, M.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Among Beagle dogs that inhaled ^{90}Sr in fused aluminosilicate particles, 32 died from radiation pneumonitis and pulmonary fibrosis within 500 days after receiving initial lung burdens in the range of 30 to 96 μCi ^{90}Sr per kilogram body weight. On average, twenty percent of the radionuclide burden was cleared with an effective half-time of 50 days; the remaining 80 percent was cleared with an effective halftime of 740 days. These lung burdens yielded a relatively constant radiation dose to lung in the range 40,000 to 99,000 rads. Dogs with initial lung burdens less than 30 μCi of ^{90}Sr per kilogram body weight did not die from early effects of radiation damage to the lung.

56445 (LMF—102, pp 322-326) **Toxicity of inhaled alpha-emitting radionuclides: status report.** Muggenburg, B.A.; Mewhinney, J.A.; Guilmette, R.A.; Hahn, F.F.; Boecker, B.B.; Mauderly, J.L.; Lundgren, D.L.; Hobbs, C.H.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A series of interrelated dose-response studies in which Beagle dogs and rodents are being exposed to aerosols of transuran-

ic alpha-emitting radionuclides is described. Monodisperse aerosols of oxides of ^{239}Pu, ^{238}Pu, ^{241}Am, ^{244}Cm and ^{243}Cm are used in studies to measure the relative importance of average organ dose, local dose around particles, specific activity, particle size and number of particles inhaled upon the development of biological effects. The elemental characteristics, chemical form, species of animal and age of the animal at the time of inhalation exposure are also being studied as they may influence the toxicity of these radionuclides.

56446 (LMF—102, pp 327-335) **Toxicity of inhaled $^{238}PuO_2$ in Beagle dogs. A. Monodisperse 1.5 μm AMAD particles. B. Monodisperse 3.0 μm AMAD particles. IX.** Mewhinney, J.A.; Hahn, F.F.; Boecker, B.B.; Diel, J.H.; McClellan, R.O.; Mauderly, J.L.; Muggenburg, B.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Beagle dogs have received an inhalation exposure to one of two sizes of monodisperse aerosols of $^{238}PuO_2$ to achieve graded levels of initial lung burden. All dogs are being studied over their life span. Eighty-two dogs have died with initial lung burdens ranging from 0.02 to 1.5 μCi ^{238}Pu per kilogram body weight; eight died with radiation pneumonitis and pulmonary fibrosis, four died with lung tumors, 61 died with bone tumors, one died with a liver tumor and seven died due to miscellaneous causes. Four control dogs have died. Sixty-two exposed and 20 control dogs are surviving at 2021 to 2849 days after inhalation exposure.

56447 (LMF—102, pp 336-343) **Toxicity of inhaled $^{239}PuO_2$ in Beagle dogs. A. Monodisperse 0.75 μm AMAD particles. B. Monodisperse 1.5 μm AMAD particles. C. Monodisperse 3.0 μm AMAD particles. V.** Muggenburg, B.A.; Guilmette, R.A.; Hahn, F.F.; Boecker, B.B.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Studies on the metabolism, dosimetry and biological effects of inhaled particles of $^{239}PuO_2$ in Beagle dogs are in progress. To obtain information on the relative importance of homogeneity versus nonhomogeneity of radiation doses to the lung, dogs have been exposed to monodisperse aerosols of $^{239}PuO_2$ of 0.75, 1.5 or 3.0 μm activity median aerodynamic diameter (AMAD). The exposures have resulted in graded initial lung burdens ranging from 0.0002 to 2.6 μCi ^{239}Pu per kilogram body weight. Other dogs were exposed to the aerosol diluent to serve as controls. Ten dogs have died in the study with 0.75 μm AMAD particles, 40 dogs have died in the study with 1.5 μm AMAD particles and 35 dogs have died in the study with 3.0 μm AMAD particles of $^{239}PuO_2$. Dogs have died with radiation pneumonitis and pulmonary fibrosis and carcinomas of the lung. The remaining dogs have survived up to 2100 days after inhalation exposure and are being observed for the remainder of their life span.

56448 (LMF—102, pp 344-346) **Toxicity of inhaled $^{239}PuO_2$ in immature Beagle dogs.** Guilmette, R.A.; Muggenburg, B.A.; Hahn, F.F.; Mauderly, J.L.; Boecker, B.B.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Immature Beagle dogs have been exposed by inhalation to a monodisperse aerosol of $^{239}PuO_2$ (1.5 μm activity median aerodynamic diameter) to compare the biological effects with those seen in young adult and aged dogs exposed to a similar aerosol. The study includes 96 dogs exposed to ^{239}Pu and 12 controls. The lung burdens in the Pu-exposed dogs range from 0.00030 to 0.80 μCi ^{239}Pu/kg body weight. During the past year, one dog died as a result of epileptic seizures. No observed biological effects of alpha irradiation have been observed with accumulated lung doses as high as 1690 rads.

56449 (LMF—102, pp 347-351) **Toxicity of inhaled $^{239}PuO_2$ in aged Beagle dogs. IV.** Muggenburg, B.A.; Hahn, F.F.; Guilmette, R.A.; Boecker, B.B.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Studies to determine the effects of age at exposure on the metabolism, dosimetry and biological effects of inhaled particles of $^{239}PuO_2$ are in progress in aged Beagle dogs (8.0 to 10.5 years of age at exposure). Forty-eight dogs have inhaled particles of $^{239}PuO_2$ having an activity median aerodynamic diameter of 1.5 μm to achieve initial lung burdens ranging from 0.02 to 0.66 μCi ^{239}Pu per kilogram body weight. Twelve dogs exposed to the aerosol diluent serve as controls. Twenty-five exposed dogs have died, including eight dogs that died during the past year. The principal cause of death was radiation pneumonitis and pulmonary fibrosis. One control dog has died. The 23 surviving exposed dogs and 11 controls are being observed.

56450 (LMF—102, pp 352-356) **Microscopic dose distribution in lung and dose-effect relationships in Syrian hamsters exposed to particles of plutonium.** Diel, J.H.; Mewhinney, J.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Syrian hamsters inhaled a monodisperse aerosol of $^{239}PuO_2$ and were serially sacrificed to study the microscopic distribution of particles, tissue at risk and dose as a function of time after exposure. An existing dose-effect model for lung cancer was fitted to lung cancer induction data for hamsters with stationary microspheres containing plutonium in their lungs. Assuming the dose pattern measured in this study, the resulting model adequately described dose-effect relationships for most studies of hamsters inhaling monodisperse and polydisperse aerosols of PuO_2.

56451 (LMF—102, pp 357-360) **Toxic effects of inhaled $^{244}Cm_2O_3$ in rats. II.** Lundgren, D.L.; Hahn, F.F.; Guilmette, R.A.; Kanapilly, G.M. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The toxicity of $^{244}Cm_2O_3$ is being studied in rats exposed by inhalation to monodisperse aerosols to achieve desired initial lung burdens of 2, 6, 17, 45, 150 and 450 nCi of ^{244}Cm. Curium-243 is being used to label the $^{244}Cm_2O_3$ so that the initial lung burden of each rat can be determined. A total of 1000 exposed rats and 158 sham-exposed control rats are being held for life span observation. Fourteen percent of the 1158 rats being held for life span have died through ~ 500 days after exposure. Deaths were due to radiation-induced lung injury or natural causes; no lung tumors were found.

56452 (LMF—102, pp 361-363) **Repeated inhalation exposure of rats to aerosols of $^{239}PuO_2$.** Lundgren, D.L.; Hahn, F.F.; Diel, J.H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The effects of protracted alpha irradiation of rat lungs are being studied. Rats are being or have been exposed once or repeatedly to aerosols of $^{239}PuO_2$ to achieve or to reestablish lung burdens of $^{239}PuO_2$ that will result in alpha radiation doses to the lungs of 20, 60, 200 or 600 rads. All of the single and six of 7 bimonthly repeated exposures have been completed and about 97% of the rats remain alive. No adverse effects from the single or repeated exposures have been observed.

56453 (LMF—102, pp 364-372) **Repeated inhalation exposure of Beagle dogs to aerosols of $^{239}PuO_2$. IV.** Diel, J.H.; Lundgren, D.L.; Muggenburg, B.A.; Guilmette, R.A.; Hahn, F.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Dogs were exposed once or repeatedly by inhalation to aerosols of $^{239}PuO_2$ to study the relative doses and effects of these two types of exposures. Dogs still alive in this study have been exposed ten times and maintained at least 4.7 years after their first exposure. To date, seven dogs have died from radiation pneumonitis and pulmonary fibrosis. Similar cumulative radiation doses give similar survival times for single and repeated inhalation exposures to $^{239}PuO_2$.

56454 (LMF—102, pp 435-438) **Incidence of urinary bladder tumors in the control Beagle dog population at the Inhalation Toxicology Research Institute.** King, R.R.; Kusewitt, D.F.; Hahn, F.F.; Muggenburg, B.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The report reviews the incidence and types of urinary bladder tumors in 94 dogs that have died in a population of 250 control dogs (median life span 14.0 years). Six bladder tumors, two papillomas and four transitional cell carcinomas, were found. The cumulative incidence for bladder tumors was 10.5 percent at 16 to 19 years of age; this was a 20 percent age-specific incidence.

56455 (PNL-SA—11596) **Effects of random dosimetry errors and the use of data on acute symptoms for dosimetry evaluation.** Gilbert, E.S. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 20p. (CONF-8309148—1). NTIS, PC A02/MF A01. Order Number DE84000111.

From SIMS conference on atomic bomb survivor data - utilization and analysis; Alta, UT, USA (12 Sep 1983).

Two approaches are used to address questions regarding dose measurement errors. The first is to describe and compare the effects of random error for several dose treatments including the use of grouped and ungrouped data, and analyses with and without truncation at 600 rad. It is found that the ways in which measurement error is most likely to mislead are through downward bias in the estimated regression coefficients and through distortion of the shape of the dose response curve. The second approach makes use of data on acute symptons to identify survivors in particular shielding situations or locations whose dose estimates may be especially biased or subject to unusual amounts of random error. It is found that the dose-response curves for acute symptoms differ considerably by many of the factors studied, but it is not possible to separate differences resulting from varying degrees of random error from systematic bias. The analyses also suggest that doses of Hiroshima survivors are in general better estimated than doses of Nagasaki survivors, a situation which could easily bias city comparisons. 17 references.

56456 **Screening for lung cancer in a fixed population by biennial chest radiography.** Hayabuchi, N.; Russell, W.J.; Murakami, J.; Nishitani, H. *Radiology;* **148**: No. 2, 369-373(Aug 1983).

All screening radiographs of the chest and other medical records of 107 patients with histologically proved lung cancer in a fixed population were reviewed to assess the efficacy of biennial chest radiography in detecting lung cancer. Radiographic abnormalities caused by tumors were initially detected in 58 patients (54%); the other 49 (46%) were detected radiographically in subsequent examinations. Thirty-six of the 40 solitary tumors were ≦ 4.0 cm in diameter when detected. There were no symptoms in 76% of cases, possibly associated with the predominance of peripheral adenocarcinomas. Routine 36 x 43-cm radiographs, posteroanterior stereoscopic and lateral projections, and comparison with previous radiographs facilitated detection of relatively small tumors in asymptomatic patients. the corrected 5-year survival rate from the time of detection was 20%.

56457 **Comparison of the lethal effects of intracellular radionuclides in human and rodent cells.** LeMotte, P.K.; Little, J.B. (Harvard School of Public Health, Boston, MA). *Radiation Research;* **95**: No. 2, 359-369(Aug 1983).

The relative sensitivities of a human diploid fibroblast strain (AG1522) and an established line of contact-inhibited mouse embryo fibroblasts (10T1/2) were compared after incorporation of [^{3}H]thymidine or [^{125}I]iododeoxyuridine into the cellular DNA and growth at 37°C. Whereas these cells show similar sensitivities to acute X irradiation, the D_0 for clonal survival of the mouse fibroblasts was 5- to 10-fold higher than the D_0 for the human fibroblasts for both ^{3}H and ^{125}I. A large difference in sensitivity between these two cell types was also seen after protracted irradiation from $^{3}H_2O$ at 37°C, but this difference was markedly reduced when cells were exposed to $^{3}H_2O$ at 0°C to simulate an acute irradiation. An established human tumor cell line was similarly hypersensitive to killing by $^{3}H_2O$ at 37°C as compared with early passage diploid hamster embryo cells. These results indicate that human cells are more radiosensitive than rodent cells when a radiation dose is protracted over several days rather than given as an acute exposure, and are consistent with the hypothesis that human cells are hypersensitive to low-dose-rate irradiation as compared with rodent cells.

56458 **Repair of sublethal damage in diploid human fibroblasts: a compoarison between human and rodent cell lines.** Freeman, M.L.; Sierra, E.; Hall, E.J. (Columbia Univ., New York, NY). *Radiation Research;* **95**: No. 2, 382-391(Aug 1983). Contract AC02-78EV04733.

Two diploid cell lines of human origin were irradiated in vitro. Repair of sublethal damage was observed in both lines when they were exposed to a single γ-ray dose and incubated at 37°C prior to receiving a graded second dose. In addition cells were irradiated at a low dose rate (56 or 76 rad/hr) and survival was compared to that after an acute exposure. A dose-rate effect was demonstrated. Sublethal damage repair was also studied using CHO or V-79 Chinese hamster cells, and the data suggest that the degree of repair is similar in human and rodent cell lines at photon doses up to 500 rad. The repair of sublethal damage can be a significant factor in the survival of human cells in vitro for fractionated doses.

56459 **Are lesions induced by ionizing radiation direct blocks to DNA chain elongation.** Painter, R.B. (Univ. of California, San Francisco). *Radiation Research;* **95**: No. 2, 421-426(Aug 1983).

Ionizing radiation blocks DNA chain elongation in normal diploid fibroblasts but not in fibroblasts from patients with ataxia-telangiectasia, even though there are no differences in the damage induced between the two cell types. This difference suggests that radiation-induced lesions in DNA are not themselves blocks to chain elongation in ataxia cells and raises the possibility that in normal cells a mediator exists between DNA damage and chain termination.

56460 **V79 survival following simultaneous or sequential irradiation by 15-MeV neutrons and ^{60}Co photons.** Higgins, P.D.; DeLuca, P.M. Jr.; Pearson, D.W.; Gould, M.N. (Univ. of Wisconsin, Madison). *Radiation Research;* **95**: No. 1, 45-56(Jul 1983).

A unique tandem source irradiation facility, composed of an intense d-T neutron source and a ^{60}Co teletherapy unit, was used to investigate biological responses for different neutron/photon configurations. V79 Chinese hamster cells, attached as monolayers in log-phase growth, were irradiated at 37°C by either 14.8-MeV neutrons, ^{60}Co, or a mixture of 40% neutrons and 60% photons in simultaneous or sequential application. Measurements of cell survival indicate an increased effectiveness in cell killing for simultaneously administered neutrons and photons compared to that measured or predicted for sequentially applied beam modalities. An understanding of the magnitude of these interactive effects is important both for calculating accurate effective doses for neutron radiotherapy of deep-seated tumors, for which the photon component is appreciable, and for determination of environmental hazards to people occupationally exposed to mixtures of photons and neutrons.

56461 **Radium retention and dosimetry in the St. Bernard.** Lloyd, R.D.; Taylor, G.N.; Jones, C.W.; Mays, C.W. (Univ. of Utah, Salt Lake City). *Radiation Research;* **95**: No. 1, 150-157(Jul 1983). Contract AC02-76EV00119.

The percentage total-body retention (R) of ^{226}Ra was determined in 14 young adult St. Bernards for the first 4 years after injection. It was found that the ^{222}Rn/^{226}Ra ratio in the skeleton was similar to that measured previously for young adult beagles given ^{226}Ra. Excretion of injected ^{226}Ra averaged about 32% in the first 2 weeks, with about 2/3 of the total appearing in the feces. St. Bernards appear to retain more ^{226}Ra than do beagles injected at the same age. The last two terms of the retention equation were used to calculate the average skeletal radiation dose rate and cumulative radiation dose normalized to each dog's individual retention measurements. Allowance was made in the calculations for the changing skeletal retention of ^{222}Rn and its radioactive daughters as a function of time.

56462 **Effects of radioprotectors on DNA polymerase I-directed repair synthesis and DNA strand breaks in toluene-treated and x-irradiated Escherichia coli.** Billen, D. (Univ. of Tennessee, Oak Ridge). *Radiation Research;* **95**: No. 1, 158-164(Jul 1983). Contract AS05-76EV04568;W-7405-ENG-26.

In Escherichia coli made permeable to nucleotides by toluene treatment, a DNA polymerase I-directed repair synthesis is induced by exposure to x rays. This repair synthesis may be amplified and easily measured through inhibition of DNA ligase action. In an effort to learn more of the relationship between x-ray-induced strand breaks in cellular DNA and the extent of this repair synthesis, experiments designed to compare the influence of radioprotectors on both strand-break production and repair synthesis have been carried out. The results show that cysteamine, sodium formate, and glycerol not only protect against strand breaks but also reduce DNA polymerase I-directed repair synthesis. However, I^-, an efficient hydroxyl radical scavenger, is not as effective a protective agent against strand breaks and does not measurably affect repair synthesis in our system.

56463 **Potentiation by caffeine of x-ray damage to cultured human skin fibroblasts from normal subjects and ataxia-telangiectasia patients.** Furcinitti, P.S. (Columbia Univ. New York, NY). *Radiation Research;* **95**: No. 1, 197-204(Jul 1983). Contract AC02-78EV04733;AC02-76CH00016.

Caffeine was found to potentiate x-ray-induced killing of human diploid fibroblasts from a normal subject and an ataxia-telangiectasia (AT) patient when it was present at 2 mM concentration for 30 to 66 h postirradiation. The dose-modifying factor for caffeine-treated normal cells had an average value of 1.26 +- 0.13 which did not vary significantly with treatment time or x-ray dose. The dose-modifying factor for caffeine-treated AT cells was 1.12 +- 0.12 at 30 h, rose to 1.66 +- 0.17 at 41 h, and decreased to 1.31 +- 0.13 at 66 h. Thus no clear difference was observed between these two cell strains' susceptibility to postirradiation caffeine treatment.

56464 **Further update of the analysis of mortality of workers in a nuclear facility.** Tolley, H.D.; Marks, S.; Buchanan, J.A.; Gilbert, E.S. (Pacific Northwest Lab., Richland, WA). *Radiation Research;* **95**: No. 1, 211-213(Jul 1983). Contract AC06-76RL01830.

The purpose of this note is to provide a second updated analysis of the data presented originally by Gilbert and Marks. The first update by Gilbert and Marks, which was based on 12,522 workers initially employed at Hanford before 1965, included deaths up to May 1977. Since that time, additional mortality information has been received, the study population has been expanded to include workers initially employed during and after 1965, and minor corrections of employment dates and other occupational information have been made.

56465 **Cataract production in mice by heavy charged argon, neon, and carbon particles.** Jose, J.G.; Ainsworth, E.J. (Lawrence Berkeley Lab., CA). *Radiation Research;* **94**: No. 3, 513-528(Jun 1983). Contract W-7405-ENG-48.

The cataractogenic potential in mice of heavy charged particles from the Bevalac was examined in relation to dose, linear energy transfer (LET), and time following exposure. BALB/c x C57/bl$_6$(CB$_6$F$_1$) mice were exposed to graded single doses (0.05 to 0.9 Gy) of 570-MeV ^{40}Ar, 425-MeV ^{20}Ne, or 400-MeV ^{12}C particles in the plateau portion of the Bragg curve. Lenses were examined by slit lamp biomicroscopy over a 21-month period. The cataract severity was scored subjectively on a scale of 0 to 4 and compared to the opacities induced by 225-kVp X rays. Both the onset and density of the lens opacities were related to dose, and opacification progressed throughout the entire period of observation. In terms of degree of opacification and rates of onset and progression, the cataractogenic response to ^{40}Ar particles was greater than to either ^{20}Ne or ^{12}C particles. Discrimination between the effects of ^{20}Ne and ^{12}C was possible only at the higher doses employed (0.6 and 0.9 Gy) and only at some observation times. Based on average cataract density at the several observation times, the relative biological effectiveness (RBE) of ^{40}Ar particles is estimated to be 3 to 5 over a cataract score range of about 1.5 to 3.0 (0.15 to 0.9 Gy). The RBE for ^{20}Ne and ^{12}C particles is probably somewhat greater than 1.0. The consistency of replicate lens examinations and challenges of the subjective scoring system are discussed.

56466 **Enriched uranium as an activatable tracer in environmental research.** Gladney, E.S.; Wallwork-Barber, M.K.; Ferenbaugh, R.W. (Los Alamos National Lab., NM (USA)). *Journal of Radioanalytical Chemistry;* **78**: No. 1, 209-212(1983).

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Isotopically enriched uranium and delayed neutron assay have been employed to study uranium dynamics within bee colonies. Preliminary data demonstrating the advantages of this activatable tracer method are presented.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 56363

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 55389, 55416, 55417, 55441, 56134, 56307, 56311, 56311, 56312, 56315, 56377, 56414, 56425, 56463

56467 **(BNL—33557) Enzymology of repair of DNA adducts produced by N-nitroso compounds.** Setlow, R.B.; Cao, E.H.; Delihas, N.C. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 25p. (CONF-8309146—1). NTIS, PC A02/MF A01. Order Number DE83017981.

From 8. international meeting on n-nitroso compounds: occurrence and biological effects; Banff, Alberta, Canada (4 Sep 1983).

The biological effects of DNA adducts depend on their nature, and on their half-lives relative to the rates of DNA replication and transcription. Their half-lives are determined by the rates of spontaneous decay, such as depurination, and the rates of enzymatic repair of the adducts or their decay products. The principle modes of repair of methylating and ethylating agents are by glycosylase catalyzed depurination of 7-alkylguanine and 3-alkyladenine and by the dealkalation of O^6-alkylguanine. Repair by dealkylation cannot be detected by the standard methods used to measure DNA repair, but it is easy to estimate the acceptor activity in cell extracts by measuring the transfer of radioactive O^6-alkyl groups in an exogenous DNA to protein. In extracts of cells treated with alkylating agents the activity is depressed because the endogenous DNA is rapidly dealkylated, using up the acceptor activity. In many cell types the decrease in activity is followed by an increase to the normal constitutive level. In other cells there is no such adaptive response. Differences in constitutive levels of methyl accepting activity in extracts of human lymphocytes and on the acceptor activity in lung macrophages from smokers (low activity) and non-smokers (high activity) have been observed. 46 references.

56468 **(CONF-810992—4) Factors affecting mutagenicity of ethylnitrosourea in the mouse specific-locus test and their bearing on risk estimation.** Russell, W.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 12p. NTIS, PC A02. Order Number DE84000208.

From 3. international conference on environmental mutagens; Tokyo, Japan (20 Sep 1981).

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The high mutagenic effectiveness of ethylnitrosourea (ENU) in the mouse specific-locus test has permitted rapid progress in investigating many of the complexities of mutagenic action in the mouse. These include effect of sex and cell stage, dose-response curve, dose fractionation and nature of the mutations. The mutagenic effect of related chemicals is markedly different. In view of the high mutational response to ENU, the weak or zero response to several chemicals that are potent mutagens in other systems cannot be attributed to insensitivity of the specific-locus test. It is probably due to an efficient repair mechanism in mouse spermatogonia. Dose fractionation experiments indicate that there is extensive repair even

against ENU-induced mutation when the dose is low enough. Many of these results raise questions about the reliability of some approaches to risk estimation. 18 references.

56469 (CONF-8305135—1) **Relationship of histochemically detectable altered hepatocyte foci to hepatic tumorigenesis.** Peraino, C.; Staffeldt, E.F.; Carnes, B.A.; Ludeman, V.A.; Blomquist, J.A.; Vesselinovitch, S.D. (Argonne National Lab., IL (USA); Chicago Univ., IL (USA). Dept. of Radiology). 1983. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01. Order Number DE84000570.

From Conference on the role of cocarcinogens and promoters in human and experimental carcinogenesis; Budapest, Hungary (16 May 1983).

A new experimental system was used to examine the stages of chemically induced hepatic neoplasia in the rat. The treatment protocol involved the intraperitoneal injection of a single nonnecrogenic dose of carcinogen [diethylnitrosamine (DEN) or benzo(a)pyrene (BAP)] into male and female rats within one day after birth, followed by dietary exposure to promotor (0.05% dietary phenobarbital) beginning at weaning. Rat livers were examined for tumors and for foci of altered hepatocytes using six histochemical markers. Foci containing between one and six markers were identified and their average sizes were calculated. The same complement of histochemical tests was applied to the primary hepatic tumors observed in this study. The data showed that (1) The new treatment protocol was highly efficient for foci and tumor production. (2) Foci growth rates and incidence levels were directly related to hepatocarcinogenic effectiveness (DEN > BAP), whereas both carcinogens had similar effects on foci phenotypic properties. (3) After their formation, foci at a given level of phenotypic complexity did not become progressively more complex. (4) Foci incidence levels were sex dependent (females > males) but foci growth rates were the same for both sexes. (5) Foci growth rates and growth capacities were directly related to foci phenotypic complexity levels. (6) Foci frequencies and phenotypic complexities were inversely related; the reverse was true for tumors, although 10% of the tumors were relatively simple (3 markers or less). (7) Marker frequency distribution patterns were completely different in foci and tumors. From these observations we suggest that the foci are manifestations of the carcinogenic stimulus on control of cell division and phenotypic character.

56470 (LMF—102, pp 64-67) **Generation of ammonium sulfite aerosols. II.** Rothenberg, S.J.; Barr, E.B.; Dahl, A.R.; Wolff, R.K.; Hanson, R.L.; Cheng, Y.S.; Silbaugh, S.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Ammonium sulfite aerosols have been produced at concentrations ranging from 1 mg/m^3 to 400 mg/m^3. A gas phase reaction of NH_3, SO_2 and excess H_2O was used. Several methods were used to reduce concentrations of residual gas (NH_3, SO_2) so that animal exposures to relatively pure sulfite aerosol could be conducted. The aerosol oxidized rapidly in air and difficulties were encountered in achieving a high percentage of sulfite in the aerosols to which animals were exposed.

56471 (LMF—102, pp 68-70) **Computer interfaced on-line serial data acquisition and control system: its application to an automated inhalation exposure system.** Gregory, R.E.; Wilson, L.R.; Godwin, M.C. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A computer-interfaced serial data acquisition system has been designed to monitor and control an inhalation exposure system in conjunction with a microcomputer. This device allowed on-line, real-time computer control and data acquisition without full-time computer commitment. The device allowed the computer to start exposures, controlled exposure regimens, controlled exposure chamber gas sampling and protocols and stopped exposures. It also continuously monitored and recorded chamber air flow, pressure, temperature and relative humidity, and sounded alarms when these parameters exceeded established limits.

56472 (LMF—102, pp 101-105) **Chemical and biological properties of diesel exhaust particles collected during selected segments of a simulated driving cycle.** Bechtold, W.E.; Dutcher, J.S.; Mokler, B.V.; Lopez, J.A.; Li, A.P.; Henderson, T.R.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Particle emissions, percentage of organic extractable materials and mutagenicities of extracts from a test stand diesel engine have been determined for the full Federal Test Procedure (FTP) driving cycle and several of its segments. Particle samples were collected using a computer-controlled high volume sampler. Extracts of the exhaust particles were screened for the potent mutagens nitropyrene/nitrofluoranthenes by mass spectrometry/mass spectrometry (MS/MS). A protracted acceleration contained within the cycle produced 12 times more mutagens per second than did the full FTP cycle. All extracts showed decreases in specific activities when assayed in nitroreductase deficient strains of TA-98 (TA-98 NR, TA-98 1,8 DNP_6). Three extracts were found to have high levels of nitropyrene/nitrofluoranthenes and two of the three had high specific mutagenic activities in TA-98. There was direct correlation between mutagenicity and average exhaust temperature.

56473 (LMF—102, pp 106-109) **Fractionation of diesel particle extracts by Sephadex LH-20 and thin layer chromatography.** Bechtold, W.E.; Dutcher, J.S.; Li, A.P.; Royer, R.E. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A two-step fractionation of organic extracts of diesel exhaust particles is described which employs Sephadex LH-20 and thin layer chromatography (TLC). In both steps, nitro-polycyclic aromatic hydrocarbons (nitro-PAH) were found to coelute with the fractions of highest specific bacterical mutagenic activity. Mass spectrometry/mass spectrometry was used to measure the intensities of ions corresponding to nitropyrene and/or nitrofluoranthene in each of the fractions. These particular nitro-PAHs showed a 170-fold enrichment in the most bioactive TLC subfraction over the starting material, for a final concentration of over 3200 ppM. Ions corresponding to several two- and three-ring methylated nitro-PAHs were observed in the same fraction, including nitro(methylbiphenyls/methylacenaphthenes) and nitro(methylanthracenes/methylphenanthrenes).

56474 (LMF—102, pp 110-112) **Mutagenicity of high pressure liquid chromatography fractions of diesel or spark ignition exhaust particle extracts.** Clark, C.R.; Seizinger, D.E.; Naman, T.M. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Exhaust particles were collected from three spark ignition and three diesel cars. The particles were extracted with CH_2Cl_2 and the extracts fractionated into six chemical classes using high pressure liquid chromatography (HPLC). The total extract and each of the fractions were tested in the Ames Salmonella mutagenicity assay using strain TA-98. The mutagenicity of the spark ignition extracts were 2 to 9 times higher per microgram than the extracts from particles produced by diesel cars. Elution on HPLC fractionated the sample into six fractions: $alpha_1$, $alpha_2$, beta, $gamma_1$, $gamma_2$ and delta. Most of the mass of the extracts was in the $alpha_1$ fraction, which contained aliphatic hydrocarbons. The $gamma_1$ fraction which contains oxygenated and nitrated polyaromatic hydrocarbons had tenfold higher mutagenic activity for both diesel and spark ignition particle exhaust extracts than observed in the crude extract. The mutagenic activity in $gamma_1$, $gamma_2$ and delta fractions from spark ignition extracts was all higher in mutagenic activity than the diesel extract although the order was the same for both car types $gamma_1$ > $gamma_2$ > delta. When both the total particulate emissions and the percent of the particulate material which was extractable by CH_2Cl_2 were considered, the exhaust from diesel cars discharged more mutagenic activity into the environment per mile than spark ignition cars.

56475 (LMF—102, pp 113-117) **GC/MS and MS/MS studies of diesel exhaust emissions from chemically defined fuels.** Henderson, T.R.; Sun, J.D.; Hanson, R.L.; Bechtold, W.E. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Polycyclic aromatic hydrocarbons (PAHs) dissolved in hexadecane were utilized as fuels in a single-cylinder diesel engine to study effects of diesel fuel aromatic content on combustion products. The direct acting mutagenic response in Salmonella and the percent extractable organics associated with soot particles were decreased using pure aliphatic fuel compared to No. 2 diesel fuel. Certain PAHs added to the aliphatic fuel selectively increased PAH emissions. Other PAHs increased the overall emissions of most PAHs and soot, and altered the types of nitro-PAHs. It is concluded that certain PAHs present in diesel fuel may significantly influence exhaust emissions of PAH, soot and nitro-PAHs.

56476 (LMF—102, pp 118-121) **Comparative mutagenicity of used crankcase oil from diesel and spark ignition powered cars.** Dutcher, J.S.; Li, A.P.; Clark, C.R. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The mutagenicity of used crankcase oil from spark ignition and diesel passenger cars was measured in Salmonella typhimurium strain TA-98. The mutagens were concentrated by extracting the oils with dimethylsulfoxide. Extracts were then diluted with water and further extracted with methylene chloride. Direct and indirect mutagenicity was observed in used crankcase oil extracts from spark ignition and diesel engines. Although mutagenic activities varied over a wide range, extracts of used crankcase oil from diesel vehicles did not appear to be significantly different from gasoline cars in mutagenic potency.

56477 (LMF—102, pp 122-124) **Mutagenicity of exhaust particle extracts from diesel cars using ethyl alcohol and methyl alcohol as fuel extenders.** Brooks, A.L.; Clark, C.R.; Dutcher, J.S.; Cox, F.; Allsup, J. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A diesel automobile was operated with varying concentrations of either ethyl alcohol (EtOH) or methyl alcohol (MeOH) as a fuel extender and particulate exhaust emissions were collected. Addition of graded levels of MeOH reduced particulate emissions and increased the organic extractable materials but had little influence on the mutagenic activity (revertants/μg) of the extracts as measured in Ames Salmonella TA-98. Addition of EtOH to the fuel had similar effects on particle emissions and organic extractable materials. Addition of EtOH had no effect on the mutagenic activity of the extract. None of the treatments had a significant influence on the total mutagenic activity discharged into the environment.

56478 (LMF—102, pp 125-128) **Toxicological and chemical characterization of process and waste streams of a low Btu gasifier.** Benson, J.M.; Henderson, R.F.; Hanson, R.L.; Dahl, A.R.; Newton, G.J. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The process and potential waste streams of an experimental low Btu coal gasifier were sampled and their chemical and toxicological properties characterized. Process materials were mutagenic in Salmonella and toxic to pulmonary alveolar macrophages in vitro. Tar effluents also were both mutagenic and cytotoxic. Gasifier bottom ash and cyclone dust had little or no biological activity. Polycyclic aromatic hydrocarbons and aza-arenes appeared to contribute to the mutagenic activity of gasifier samples. Several toxic phenols were identified in cytotoxic fractions of gasifier tar.

56479 (LMF—102, pp 129-137) **Reductions in the mutagenicities of coal tars and SRC-II materials by nitrosation and acylation.** Bechtold, W.E.; Dutcher, J.S.; Li, A.P.; Newton, G.J.; Henderson, R.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Two reactions which chemically alter aromatic amines were used in an effort to assess the contribution of primary aromatic amines to the indirect bacterial mutagenicity of low Btu gasifier tar trap tar. Nitrous acid was shown to generate direct mutagenic activity which limited the interpretation of results. Acylation of the tar indicated that part, but not all, of the activity was due to primary aromatic amines.

56480 (LMF—102, pp 138-141) **Comparison of three short-term tests for predicting the genotoxicity of coal conversion process materials.** Shimizu, R.W.; Brooks, A.L.; Benson, J.M.; Li, A.P. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Organic extracts of three complex environmental mixtures (crude gasifier process effluent) were examined for genotoxicity. Three short-term assay systems were used: Salmonella mutation assay, Chinese hamster ovary (CHO) cell/hypoxanthine-guanine phosphoribosyl transferase (HGPRT) mutation assay, and the Chinese hamster lung (CHL) primary culture/sister chromatid exchange (SCE) assay. Induced liver S-9 from rats was required for activation of the mixtures in both the bacterial and CHO/HGPRT assays but not in the CHL/SCE assay. The mixtures were ranked in the bacterial test with respect to genotoxicity: crude gasifier material > coke oven extract >> clean coal gas. In the CHO/HGPRT assay, they were ranked: coke oven extract >> crude gasifier material; clean coal gas was not tested. In the CHL/SCE assay, they were ranked coke oven extract > crude gasifier material >> clean coal gas. In all three tests, it appeared the cleanup process used in this gasifier greatly reduced the genotoxocity of process stream material. These data show that genotoxicity evaluation of crude organic mixtures must be determined using a variety of test systems.

56481 (LMF—102, pp 142-144) **Comparative mutagenic activity of complex environmental pollutants measured in bacteria and mammalian cells.** Brooks, A.L.; Li, A.P.; Clark, C.R. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Dichloromethane extracts of (1) fly ash from fluidized bed coal combustion, (2) coal gasifier tar, (3) coke oven mains, (4) spark ignition exhaust particles, (5) diesel engine exhaust particles, (6) cigarette smoke, and (7) roofing tar condensates were evaluated for mutagenicity in Chinese hamster ovary (CHO) cells at the hypoxanthine-guanine phosphosibosyl transferase (HGPRT) gene locus and in the Salmonella typhimurium Ames Test. Mutagenic potency of the extracts from these pollutants covered a range of about 100-fold for both assays. The most active extracts in the CHO/HGPRT test were from roofing tar and coke oven; fly ash and gasifier tar extracts were the most active in the Salmonella test. Diesel exhaust and cigarette smoke extracts had little mutagenic activity in either test. No correlation in the mutagenicity of the extracts was observed for these two assays. This may be related to the differing sensitivity of the two assays to chemials such as nitropyrenes.

56482 (LMF—102, pp 148-152) **Simple dynamic flow-through exposure system for assessment of biological activity of complex organic mixtures in mammalian cells in vitro.** Benson, J.M.; Zamora, P.O.; Dahl, A.R.; Hanson, R.L. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A system for in vitro exposure of lung epithelial cells and Chinese hamster ovary cells maintained at an air-medium interface to volatile organic compounds has been developed. The system has been used for exposure of cells to phenol and to a complex mixture of organic compounds from an experimental coal gasifier. A linear relationship was found between vapor generator air flow rate and concentrations of test compounds in the exposure chamber. Gas chromatographic analyses of exhaust vapor from the chamber indicated that a majority of the compounds present in the crude mixture had been volatilized.

56483 (LMF—102, pp 153-155) **Evaluation of cytotoxicity and mutagenicity of toxic gases and vapors in mammalian cells in vitro.** Zamora, P.O.; Benson, J.M.; Marshall, T.C.; Brooks, A.L. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Lung epithelial cells (LECs) and Chinese hamster ovary (CHO) cells were grown on collagen gels and exposed at an air/collagen interface to a dynamic flow of either phenol, a volatile fraction of the process stream of a coal gasifier or nonparticulate diesel exhaust. In addition, CHO cells were exposed to ethylene oxide. Cytotoxicity (LECs and CHO cells) and mutagenicity (CHO cells) were monitored. The exposure system using cells grown on collagen gels should be useful in the in vitro analysis of the toxicity of volatile compounds.

56484 (LMF—102, pp 156-159) **Use of soft agar to improve the sensitivity of the CHO/HGPRT mutation assay.** Shimizu, R.W.; Li, A.P. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Sensitivity of the Chinese hamster ovary (CHO) cell/hypoxanthine-guanine phosphoribosyl transferase (HGPRT) mutation assay was improved by increasing the population of cells treated and subsequently selecting mutants in medium containing 6-thioguanine and soft agar. Soft agar allowed the dispersion of a greater number of cells in a three dimensional matrix and minimized cross-feeding. This procedure produced a well-defined dose-response relationship at low doses (0 to 50 μg/ml) of ethyl methane sulfonate. Nine mutant populations were examined for HGPRT activity and were found to have less than 0 percent wild type activity. The increased sensitivity of this procedure may be valuable in assessing mutagenic potential of environmental mixtures for which only small amounts of material can be tested because of low solubility or high cytotoxicity.

56485 (LMF—102, pp 160-163) **Involvement of reduced glutathione in the mutagenicity induced by diesel exhaust.** Sun, J.D.; David, C.L.; Li, A.P. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

In this study, it was found that some diesel exhaust organic compounds can nonenzymatically react with reduced glutathione (GSH) which is a tripeptide found in all cells and can act to detoxify potentially toxic chemicals. The toxicological significance of these reactions was seen by a fourfold decrease in the direct-acting bacterial mutagenicity (TA-98) of diesel exhaust extract that had been pretreated with GSH as compared to untreated extract. In addition, when bacterial GSH was decreased by diethylmaleate, the mutagenicity of diesel exhaust extract was increased three- to fourfold. Thus, diesel engine exhaust contains mutagenic compounds which can be detoxified by GSH.

56486 (LMF—102, pp 164-166) **Mutagenicity of mono-, di- and trinitropyrenes in Chinese hamster ovary cells.** Dutcher, J.S.; Li, A.P. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

One-nitropyrene (1-NP), 1,3-dinitropyrene (1,3-DNP), 1,6-dinitropyrene (1,6-DNP), 1,8-dinitropyene (1,8-DNP), and 1,3,6-trinitropyrene (1,3,6-TNP) were tested for mutagenicity in cultured Chinese hamster ovary (CHO) cells at the hypoxanthine-guanine phosphoribosyl transferase (HGPRT) gene locus. Trace amounts of these compounds are found in environmental pollutants such as diesel exhaust emissions and coal-combustion fly ash. Human exposure to nitroarenes via cigarette smoking has also been suggested. While 1-NP and 1,3-DNP had only marginal direct-acting mutagenicity, 1,6-DNP, 1,8-DNP and 1,3,6-TNP showed definite mutagenicity. The mutagenicity of 1-NP increased with increasing concentrations of S-9 in the treatment medium. However, S-9 decreased the mutagenicity of 1,6-DNP and 1,8-DNP. Low concentrations of S-9 enhanced the mutagenicity of 1,3-DNP and 1,3,6-TNP while high concentrations decreased their mutagenicity. The direct-acting mutagenicity in CHO cells suggests that there may be mammalian nitroreductases capable of converting nitroarenes to mutagenic metabolites.

56487 (LMF—102, pp 167-171) **Mixed function oxidase induction in mouse lung and its effect on the covalent binding and DNA adduct formation of aromatic hydrocarbons.** Mitchell, C.E. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The induction of mixed function oxidases (MFO) in mouse lung and its effect on aromatic hydrocarbon covalent binding and DNA adduct formation were investigated. Intratracheal instillation of P-450 type (MFO) inducers (phenobarbital, dieldrin, chlordane, kepone, DDT) in male CD-1 mice was ineffective in inducing P-450 MFOs in mouse lung. Instillation of benzo(a)pyrene (a specific P-448 type inducer), Aroclor-1254 and coal tar induced significant levels of lung benzo(a)pyrene (BaP) hydroxylase activity. Pretreatment of mice with BaP, Aroclor-1254, and coal tar increased the covalent binding of ^{3}H-benzo(a)pyrene (^{3}H-BaP) and ^{3}H-2-aminoanthracene to mouse lung DNA. The ^{14}C-phenanthridone was not bound to DNA in uninduced or induced animals. Binding was persistent 1 week after administration of labeled compounds. Sephadex LH-20 chromatography of deoxyribonucleosides from lung DNA of mice instilled with ^{3}H-BaP showed that a significant portion of the bound radioactivity could be separated out as nucleoside-BaP adducts.

56488 (LMF—102, pp 172-178) **Rat nasal tissue activation of benzo(a)pyrene and 2-aminoanthracene to mutagens in Salmonella typhimurium.** Bond, J.A.; Li, A.P. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The capacity of male Fischer-344 rat nasal tissue to bioactivate benzo(a)pyrene (BaP) and 2-aminoanthracene (2-AA) to mutagens in Salmonella typhimurium was investigated. Both 2-AA and BaP were mutagenic in strains TA-98 and TA-100 when nasal tissue S-9 was utilized as the activating enzyme system. At all doses and protein concentrations tested, 2-AA displayed nearly 500 to 1000 times greater bacterial mutagenicity than BaP. In strain TA-100, nasal tissue S-9 was approximately twice as active toward 2-AA as lung S-9 and 75% as active as liver S-9. These results indicate that rat nasal tissue can metabolize promutagens to reactive species which may play an important role in xenobiotic-induced nasal tumors.

56489 (LMF—102, pp 179-185) **Retention of monodisperse or polydisperse aluminosilicate particles inhaled by dogs, rats and mice.** Snipes, M.B.; Boecker, B.B.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

This study compared long-term retention of four aerosols of ^{134}Cs-labeled fused aluminosilicate particles inhaled by dogs, rats and mice. Tissues and excreta were collected for up to 850 days after exposure to determine retention and clearance patterns of the inhaled particles. Simulation models were developed for each animal species and aerosol. After accounting for solubility, physical clearance of particles from the lung to the gastrointestinal tract and lung-associated lymph nodes (LALNs) was independent of particle size within the size range studied (geometric size 0.35 to 1.8 μm). Rats and mice demonstrated a rapid clearance from the pulmonary region, with most of the mechanically-cleared particles going to the gastrointestinal tract; significant translocation to the LALNs occurred for only a few days. The dogs cleared deposited particles at a slower rate, with most of the long-term clearance going to LALNs. A small portion of the initial deposit was retained in the upper respiratory tract of all three species.

56490 (LMF—102, pp 186-189) **Predictive model for the fate of relatively insoluble particles inhaled by people.** Snipes, M.B.; Boecker, B.B.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Results from a study with dogs were used to predict the long-term retention patterns of particles in lung and lung-associated lymph nodes of persons chronically exposed by inhalation to aerosols. The model includes aerosols having particles with dissolution rates of 0.01 to 0.00001 per day and predicts the extent to which the lymph node and lung burdens of inhaled particles depend on solubility of the particles in the lung and lymph nodes.

56491 (LMF—102, pp 190-194) **Lobar deposition and retention of relatively insoluble particles in beagle dogs.** Boecker, B.B.; Hobbs, C.H.; Snipes, M.B. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The relative distributions of lung lobar weights and radioactivity associated with insoluble particles have been determined as a function of time after inhalation exposure in Beagle dogs. Different radioactivity/lung weight ratios observed in the different lobes indicated that the apical lobes had proportionately more particles deposited per lobe weight and the diaphragmatic lobes had proportionately less particles deposited per unit lobe weight than the overall ratio for the lung as a whole. These differences amounted to about +-20% and could be reflected to corresponding differences in absorbed radiation dose, particularly for beta emitters. These differences were consistent over the entire observation period (1 hour to 3 years after exposure), indicating that the clearance processes for insoluble materials were equally effective in all lobes.

56492 (LMF—102, pp 195-198) **Availability of inhaled particles for removal by lavage in rats and dogs.** Snipes, M.B.; Whaley, S.L.; Muggenburg, B.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Dogs and rats were subjected to total lung lavage procedures at 1, 3, 10 or 25 days after inhalation of particles labeled with ^{134}Cs. Comparable quantities of particles were removed by lavage from dogs and rats on days 1 and 3; slightly larger quantities of the lung burden of particles were removed from lungs of rats on days 10 and 25. The distribution of particles in lung with and without the lavage treatment was comparable among lung lobes. Work is in progress using autoradiography of 1 to 2 μm thick sections of lung tissue to define the retention sites for particles retained in lungs of lavaged and control animals.

56493 (LMF—102, pp 212-215) **In vitro dissolution models for predicting in vivo behavior of barium aerosols.** Griffith, W.C.; Boecker, B.B.; Cuddihy, R.G. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

This report describes a simple multicompartment model for Ba in which in vitro dissolution studies can be directly incorporated to predict the absorption of Ba from particles deposited in the lung by inhalation. The model is shown to predict the patterns of retention and excretion of Ba and is compared to a similar model for Am. The approach used in this report appears to be promising for predicting in vivo retention from in vitro dissolution tests.

56494 (LMF—102, pp 216-220) **Deposition of 0.1 μm aggregate and spherical $^{67}Ga_2O_3$ particles inhaled by Beagle dogs.** Wolff, R.K.; Kanapilly, G.M.; Cheng, Y.S.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Respiratory tract deposition of inhaled $^{67}Ga_2O_3$ particles, aggregate and spherical, was studied in a group of 10 Beagle dogs following nose-only inhalation exposures. Activity median diameter for the aggregate and spherical particles, as measured by a diffusion battery, were 0.07 +- 0.01 μm (mean +- SD) with a geometric standard deviation (σ g) of 1.6, and 0.12 +- 0.03 μm (σ g = 1.8), respectively. Whole-body counting and gamma camera imaging techniques were used to determine deposition as a percentage of the inhaled particles. Values for the aggregate and spherical particles were, respectively: total respiratory tract, 39 +- 19 percent and 42 +- 17 percent; pulmonary, 25 +- 12 percent and 29 +- 11 percent. This similarity in deposition patterns shows that data from ultrafine aggregate particles can be generalized to small spherical particles when diffusion diameter is used to characterize particle size.

56495 (LMF—102, pp 224-228) **Accumulation of diesel soot in lungs of rodents exposed in life span studies to diluted diesel exhaust.** Henderson, R.F.; Wolff, R.K.; Mauderly, J.L.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Levels of diesel soot in the lungs of rodents exposed chronically to 350 μg diesel exhaust particles/m^3 reached a steady state after approximately 6 months of exposure in rats and approached equilibrium in mice after 18 months. This represented lung clearance half-time for low levels of soot in the lungs of ~ 140 days. Higher levels of exposure resulted in steadily increasing levels of soot in the lung and longer clearance times. Based on these data, exposure to street canyon levels of 15 to 30 μg diesel exhaust particles/m^3 should not result in accumulation of soot in the lung.

56496 (LMF—102, pp 229-232) **Respiratory tract clearance of ^{14}C-labeled diesel exhaust compounds inhaled associated with diesel particles or as a particle-free extract.** Sun, J.D.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

^{14}C-labeled diesel exhaust compounds on diesel soot or dichloromethane extracts of these particles were intratracheally instilled into Fischer-344 rats. Lung clearance of ^{14}C radioactivity occurred in two phases. The initially rapid phase of clearance of both soot-associated and extract-associated radioactivity was similar (t/sub 1/2/ ≃ 3 hours). However, the second, long-term component of clearance of the particle-associated ^{14}C radioactivity was much slower (t/sub 1/2/ ≃ 25 days) than that of the extract-associated radiolabel (t/sub 1/2 ≃ 2.9 days). Tracheal clearance of ^{14}C radioactivity in both instillation studies was rapid and similar (t/sub 1/2/ ≃ 10 to 12 hours). Also, small levels of ^{14}C radioactivity were detected in the stomach of animals given the soot-associated ^{14}C radioactivity 3 to 12 hours after instillations, whereas virtually no radiolabel was ever detected in the stomach of rats instilled with the ^{14}C radiolabeled diesel exhaust extracts. These studies showed that organic compounds on diesel soot can be removed from lungs by mucociliary clearance of whole particles and also by direct blood absorption of these compounds once they have been removed from diesel soot. These results also indicate that the rate limiting step of lung clearance of diesel soot-associated organic compounds may be the rate at which these compounds are removed from soot particles in situ prior to clearance.

56497 (LMF—102, pp 233-237) **Lung retention and metabolic fate of inhaled benzo(a)pyrene associated with diesel exhaust particles.** Sun, J.D.; Wolff, R.K.; Kanapilly, G.M.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Rats were exposed by nose-only inhalation to ^3H-BaP adsorbed onto diesel exhaust particles. Lung clearance of inhaled ^3H radioactivity occurred in two phases; an initial rapid phase with a half-time of less than 1 hour and a long-term component with a halftime of 18 +- 2 (mean +- SD) days. The slower phase represented 50 +- 2 percent of the ^3H-BaP initially deposited in lungs. In contrast, previous inhalation studies using pure aerosols of ^3H-BaP showed that > 99 percent of the ^3H radioactivity initially deposited in lungs was cleared within 2 hours after exposure. By high performance liquid chromatography analysis, the majority of the diesel soot-associated ^3H radioactivity retained in lungs was benzopyrene (BaP) (65 to 76 percent); smaller amounts of OH-BaP (13 to 17 percent) and BaP quinone (5 to 18 percent) metabolites were also detected. No other known BaP metabolites were found in lungs of exposed rats. These results suggest that inhaled polycyclic aromatic hydrocarbons may be retained in lungs longer when they are associated with insoluble, carrier particles than when they are inhaled as pure compounds. Also, these compounds may be metabolized in lungs prior to clearance.

56498 (LMF—102, pp 238-242) **Tissue distribution and clearance of inhaled ^{14}C-phenanthridone in rats.** Dutcher, J.S.; Mitchell, C.E. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The tissue distribution and clearance of radioactivity in rats after inhalation of a representative aza-arene, ^{14}C-phenanthridone, were determined. Radioactivity was rapidly absorbed from the respiratory tract and distributed to all tissues examined. It was rapidly eliminated from most tissues (>80 percent of initial tissue burden in 12 hours), being concentrated only in the large intestine at later times. The amount of radioactivity excreted in urine and feces was more than the calculated pulmonary deposition, indicating that material was also ingested by grooming and coprophagy. Therefore, ^{14}C-phenanthridone was also administered orally to assess its absorption from the gastrointestinal tract. Absorption was nearly complete (83 +- 6 percent SE), indicating that phenanthridone ingested as a result of mucociliary clearance and swallowing, grooming or coprophagy could also contribute to tissue exposure.

56499 (LMF—102, pp 243-247) **Disposition and fate of benzo(a)pyrene and 2-aminoanthracene in rats following inhalation of coal tar aerosols containing ^{14}C-benzo(a)pyrene and ^{3}H-2-aminoanthracene.** Mitchell, C.E.; Wong, B.A.; Dutcher, J.S.; Newton, G.J.; Henderson, R.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Male Fischer-344 rats were briefly exposed nose-only to aerosols of coal gas condensate (CGC). The aerosol (47 μg/liter; 1.18 μm mass median aerodynamic diameter) was spiked with ^{3}H-2-aminoanthracene (^{3}H-2-AA) and ^{14}C-benzo(a)-pyrene (^{14}C-BaP). The ^{3}H-2-AA and ^{14}C-BaP and/or their metabolites were distributed throughout the body immediately after inhalation exposure. Significant quantities of radioactivity were found in the lung, trachea and turbinates. The retention of ^{3}H-2-AA or its metabolites by lung tissue was higher than retention of pure ^{3}H-2-AA. In contrast, the retention of ^{14}C-BaP or its metabolites was similar when inhaled as complex chemical pollutant or when inhaled as a pure ^{14}C-BaP. Approximately 80 percent of the ^{3}H and ^{14}C were excreted in feces. By 48 hours after exposure, 90 percent of the total inhaled ^{14}C and 90 percent of the total inhaled ^{3}H were eliminated. The slow clearance of ^{3}H from the lung may have been related to the retention of the parent compound, a metabolite, or a complex chemical product of 2-AA and other chemicals present in CGC. Studies are under way to identify the compounds that the retained ^{3}H is associated with.

56500 (LMF—102, pp 248-252) **Metabolism of ^{3}H-nitropyrene in rats.** Dutcher, J.S.; Sun, J.D.; Henderson, T.R. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The excretion and metabolism of ^{3}H-1-nitropyrene were studied after intraperitoneal administration to rats. Radioactivity was eliminated in urine and feces. Tentative identification of two urinary metabolites suggested that nitro-reduction was a major pathway of nitropyrene metabolism in rats. Substantial loss of the ^{3}H-label upon metabolism prevented quantitation of metabolites or determination of excretion rates.

56501 (LMF—102, pp 253-255) **Biliary excretion and enterohepatic circulation of ^{3}H-nitropyrene.** Medinsky, M.A.; Shelton, H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Nitropyrene (NP), present in diesel emissions, is activated by bacteria with nitroreductase enzymes. Intestinal bacteria also have nitroreductase activity. The objective of this study was to determine the significance of bile in providing a mechanism for interaction of NP and reductive bacteria. The bile ducts of male Fischer-344 rats were cannulated and 0.2 or 0.3 μmoles ^{3}H-NP/kg were given intravenously. Bile, urine and feces were collected for 24 hours. Biliary excretion accounted for 60 and 80 percent of the high and low dose, respectively. A higher percent of the dose appeared in urine of control rats injected with ^{3}H-NP but without bile duct cannulations, suggesting reabsorption of NP metabolites via the enterohepatic cycle. These results indicate that bile is an important route of excretion for NP, enabling the interaction of NP with reductive bacteria.

56502 (LMF—102, pp 379-389) **Life span study of rodents inhaling diesel exhaust: results through 18 months.** Mauderly, J.L.; Benson, J.M.; Bice, D.E.; Henderson, R.F.; Jones, R.K.; McClellan, R.O.; Mokler, B.V.; Pickrell, J.A.; Redman, H.C.; Wolff, R.K. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A life span study of rats and mice exposed chronically by inhalation to diluted diesel exhaust continued through 18 months of exposure. Animals are exposed 7 hours/day, 5 days/week to exhaust at particle concentrations of approximately 7000, 3500 or 350 μg/m^{3}. Health effects end-points are evaluated at 6-month intervals. There have been no exposure-related differences in mortality, body weight or tracheal mucociliary particle clearance. Particle clearance from the deep lung was slowed in a dose-related manner and the lung burdens of particles increaed progressively at the higher exposure levels. Lung tissue responses to accumulated particles included inflammation, epithelial metaplasia and focal fibrosis. Respiratory function was significantly impaired in rats at the highest exposure level. Dose-related changes in pulmonary immunological function and lung xenobiotic enzyme activities were observed. No adverse health effects have been observed in animals at the lowest exposure level.

56503 (LMF—102, pp 390-394) **Biochemical and cytological response in airways of rodents exposed in life span studies to diluted diesel exhaust.** Henderson, R.F.; Sun, J.D.; Mauderly, J.L.; McClellan, R.O. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Long-term (18 months) exposure of rats and mice to diluted diesel exhaust resulted in a persistent inflammatory response in the bronchoalveolar airways at exposure levels of 3.5 to 7.0 mg diesel exhaust/m^{3}. However, more environmentally relevant levels of exposure (0.35 mg diesel exhaust/m^{3}) did not produce an inflammatory response.

56504 (LMF—102, pp 395-400) **Effect of 12 months of exposure to diesel exhaust on lung proteinolytic activity, connective tissue, respiratory function and histopathology.** Pickrell, J.A.; Mauderly, J.L.; Gregory, R.E.; Jones, R.K. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Rats and mice were exposed to different levels of diesel exhaust. A qualitative relation between lung burden and histological, physiological and biochemical response was observed. Focal histological changes in rats consisted of aggregations of particle-laden macrophages, focal alveolar fibrosis and pleural thickening. Mice at the highest exposure level had only widely-scattered focal areas of fine alveolar interstitial fibrosis. Marginally-increased total lung collagen and physiologic evidence of restrictive lung disease in rats supported the observation of focal histologic fibrosis. Rats which received high-level exposures developed pulmonary fibrosis had changes suggesting an increased turnover of pulmonary support tissue and less ability to produce pulmonary elastin.

56505 (LMF—102, pp 401-407) **Comparative inhalation toxicity of fly ash from pulverized and fluidized bed combustion of coal.** Hobbs, C.H.; Carpenter, R.L.; Bice, D.E.; Mauderly, J.L.; Pickrell, J.A.; Silbaugh, S.A.; Hahn, F.F.; Henderson, R.F.; Wolff, R.K. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Fischer-344 rats were exposed 5 days per week, 7 hours per day for four weeks to aerosols of fly ash collected from a pulverized coal combustion (PCC) power plant or to fly ash collected from a fluidized bed combustor (FBC). The concentration of fly ash in the exposure chamber was ~ 37 mg/m^{3} with a mass median

aerodynamic diameter of 2.7 μm for each of the three exposure groups. Animals were sacrificed at 2, 4, 6, 26, 42 or 52 weeks after start of the exposures, and functional, biochemical, immunological and morphological endpoints were evaluated. At the end of exposure, about 2 mg of fly ash was in the lungs of the animals. There were no significant differences between exposed and control animals in the respiratory function values examined after exposure or between groups of animals exposed to the different fly ashes. Deep lung clearance of a second aerosol ($^{67}Ga_2O_3$) was significantly longer in the exposed animals (PCC and FBC). Biochemical and cytological changes in lavage fluid indicated a mild pulmonary inflammation from both ashes that persisted for up to 26 weeks after exposure. On histopathological examination and in immunological studies, increased size of lung-associated lymphoid tissue and thoracic lymph nodes of the exposed animals was observed. The fly ashes from PCC and FBC used in this study have relatively low inhalation toxicities based on the parameters measured.

56506 (LMF—102, pp 408-412) **Cytokinetic changes in the lungs and thoracic lymph nodes of the rat after inhalation of fly ash.** Shami, S.G.; Silbaugh, S.A.; Hahn, F.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Cellular proliferation as measured by labeling indices in airway and alveolar epithelial cells, pulmonary macrophages and thoracic lymph nodes was elevated in Fischer-344 rats after 2 and 4 weeks exposure to 36 mg fly ash/m³. Two weeks after the end of exposure, labeling indices for rats exposed to fly ash returned to the value in controls. These values were elevated compared to previous control levels. Twenty-two weeks after exposure, proliferation in airway cells returned to con-trol levels while proliferation in other lung cells and lymph nodes increased relative to controls at early times.

56507 (LMF—102, pp 413-417) **Cytokinetics in the rat lung after inhalation of gallium oxide, sulfur dioxide and particle-associated benzo(a)pyrene.** Shami, S.G.; Wolff, R.K.; Griffith, W.C.; Brooks, A.L. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Fischer-344 rats were exposed by nose-only inhalation to a combination of benzo(a)pyrene (6.7 mg/m³), gallium oxide (22 mg/m³) and SO_2 (5 ppM) or gallium oxide (37 mg/m³), and SO_2 (5 ppM) for 2 hours per day for 9 days. Serial sacrifices were performed up to 28 days after the beginning of exposure. Cell proliferation in most lung and lung-associated lymph node cells was enhanced at days 8 through 21 in both grouped compared to sham-exposed controls. Labeling indices increased at 28 days in the lungs of controls after start of exposure such that there was no difference between exposed and control groups at this time.

56508 (LMF—102, pp 418-422) **Effect of acute ozone exposure on the elastase-antielastase balance in the rat lung.** Gregory, R.E.; Cole, D.J.; Pickrell, J.A.; Hahn, F.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Current theories on the pathogenesis of emphysema suggest that it may result from an imbalance between the elastase and α_1-proteinase inhibitor (α_1PI) activities in the alveolar structures. Oxidants reduce α_1PI's elastase inhibitory capacity. This study was designed to investigate the in vivo effect of ozone on the elastase-antielastase balance in the rat lung. Ozone exposure produced a decrease in antielastase activity at exposure levels of 0.5 and 1.0 ppM O_3 for 48 hours. After exposure to 1.5 ppM O_3 for 48 hours, normal antielastase activity was measured in the lung tissue. The later change was accompanied by a forty-fold increase in airway protein, massive hemorrhage, up to five-fold increase in airway antielastase and acute inflammation around the bronchioles. Exposure to low levels of O_3 produces elastase-antielastase imbalance in the lung, conditions which could favor the development of chronic lung disease.

56509 (LMF—102, pp 423-427) **Subchronic inhalation exposure of guinea pigs to formaldehyde.** Marshall, T.C.; Hahn, F.F.; Henderson, R.F.; Silbaugh, S.A.; Hobbs, C.H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Male Hartley guinea pigs, 15 weeks old, were exposed for 6 hours/day, 5 days/week for 8 weeks to 0, 1 or 11 mg formaldehyde/m³. Animals were killed at 1 or 30 days after completion of exposures and tissue samples were taken for histology and lung biochemistry. Nasal mucous clearance velocity increased by 35 percent after 4 weeks of exposure to 11 mg formaldehyde/m³ and tracheal mucous clearance velocity increased fortyfold by 4 weeks after completion of exposure. Dose-related histological findings included hyperkeratosis in the nasal cavities at both exposure levels and foci squamous metaplasia of respiratory epithelium lining the nasal septum at the high level. Thirty days after exposure, squamous metaplasia had resolved; however, slight hyperkeratosis was still present in pigs exposed to 11 mg formaldehyde/m³. No differences were observed on sensitivity of airways to inhaled histamine, body weights or lung biochemical endpoints between air control and formaldehyde-exposed guinea pigs. This study showed that observed adverse effects of repeated, low-level exposure of guinea pigs to formaldehyde were confined to the nasal cavity.

56510 (LMF—102, pp 428-434) **Inhalation exposure of Beagle dogs to 2,2,2-trifluoroethanol.** Marshall, T.C.; Hahn, F.F.; Landy, R.B.; Hobbs, C.H. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A whole body inhalation exposure system was constructed for exposure of Beagle dogs to vapors of 2,2,2-trifluoroethanol (TFE), a known testicular toxin. Two separate 1-week exposures were conducted on dogs as toxicity range findings studies so that proper exposure levels could be selected for longer term inhalation studies. Two dogs were exposed for 6 hours/day for 5 days at 230 +- 6 mg TFE/m³ and one of these dogs was subsequently exposed for 5 days to 900 +- 60 mg/m³. Hematology, routine clinical chemistries, semen quality and serum testosterone concentrations were monitored. Dogs were sacrificed 3 days after exposure and selected tissues were examined histologically. No effects were observed at the lower exposure level, but severe acute and testicular toxic effects were seen at the higher level. On the basis of these findings, exposure levels of 100 and 400 mg TFE/m³ were selected for an 8-week exposure of 12 Beagle dogs.

56511 (LMF—102, pp 439-444) **Chronic bronchitis in dogs exposed to SO_2.** Greene, S.A.; Wolff, R.K.; Hahn, F.F.; Mauderly, J.L.; Lundgren, D.L. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

The effects of repeated inhalation of sulfur dioxide (SO_2) gas on the airways of adult Beagle dogs were studied. Twelve dogs were exposed to 500 ppM SO_2 for 2 hours/day, 5 days/week for 22 weeks and four dogs were sham-exposed to filtered air. Exposure effects were evaluated by periodically examining the dogs for clinical signs and for changes in pulmonary function, chest radiography and tracheal mucous clearance. Dogs were sacrificed after 13 weeks of exposure. Repeated inhalation of SO_2 produced chronic bronchitis in the Beagle dog.

56512 (LMF—102, pp 445-449) **Pilot study to determine the utility of Chloramine-T for producing pulmonary emphysema in dogs.** King, R.R.; Hahn, F.F. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

Nine adult, female Beagle dogs were used in a pilot study to determine if the toluene-sulfonamide derivative, Chloramine-T, would produce the panacinar type of pulmonary emphysema and lowered serum elastase inhibitory capacity similar to those found in people with alpha$_1$-proteinase inhibitor deficiency. Two routes of administration (intratracheal and intravenous) were used. Four dogs died following treatment, probably of hypercarbaminohemoglobine-

mia. Five dogs were sacrificed after being treated for 40 to 113 days. They had developed lung lesions and serum biochemical changes typical of alpha$_1$-proteinase inhibitor deficiency, suggesting that Chloramine-T has promise as an agent for modeling pulmonary emphysema in dogs.

56513 **(LMF—102, pp 478-479) Error propagation for evaluation of large errors in risk assessment.** Seiler, F.A. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A major aspect of both experimental and theoretical work is the evaluation of uncertainties. Analytical calculations of error propagation are usually restricted to small relative errors. In many disciplines such as biology and risk assessment, however, errors may be large and uncertain. It is shown here that even for large errors, an analytical treatment is possible in many cases. These instances can be identified by an analysis of the overall algebraic structure of the calculation.

56514 **(NUREG/CR—3118-Vol.1) Health effects of occupational exposure to hazardous chemicals: a comparative assessment with notes on ionizing radiation. Executive summary. Vol. 1.** Zanetos, M.A.; Warling, J.C.; Marsh, G.M. (Battelle Columbus Labs., OH (USA)). Sep 1983. 30p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900063.

This three-part report provides quantitative estimates of the risk of cancer and other diseases among persons exposed to hazardous substances in the workplace. The risk estimates presented are based on a comprehensive review of recent epidemiologic studies. Primary emphasis was placed on studies of workers exposed to hazardous chemicals under conditions typical of a given industry over a working lifetime. Despite finding over 100 chemicals associated with increased incidence of disease, convincing dose-response trends existed for only a few. Although there were notable exceptions (arsenic, asbestos, PAH's, etc.), it was generally impossible to estimate risk-per-unit of dose in a manner analogous to calculations which exist for radiation exposure. The principal reason for this is the lack of adequate environmental monitoring data for the specific chemicals, locations, and time periods needed to estimate individual cumulative doses. In addition to analyzing risk in terms of increased incidence of specific diseases, we also examined life expectancy and years of life lost due to cancer in four selected occupational groups via a life table model which allowed for competing risks. The resulting estimates indicated that the overall life expectancy of these groups was generally greater than that of the general population but that the workers suffered greater loss of life expectancy (LLE) due to cancer than their counterparts in the general population. Published estimates of LLE due to radiation induced cancer indicate that at doses of $\leq$ 0.5 rem/y, radiation workers are projected to suffer less LLE than any of the four non-nuclear cohorts examined. At 5 rem/y (the MPD) or higher, LLE may be greater than one or more of the cohorts examined. This is Volume I of a three volume series. 12 references.

56515 **(NUREG/CR—3118-Vol.3) Health effects of occupational exposure to hazardous chemicals: a comparative assessment with notes on ionizing radiation. Abstracts of NIOSH criteria documents. Vol. 3.** Zanetos, M.A.; Warling, J.C. (Battelle Columbus Labs., OH (USA)). Sep 1983. 187p. NTIS, PC A09/MF A01 - GPO $6.00. Order Number DE84900060.

This three-part report provides quantitative estimates of the risk of cancer and other diseases among persons exposed to hazardous substances in the workplace. The risk estimates presented are based on a comprehensive review of recent epidemiologic studies. Primary emphasis was placed on studies of workers exposed to hazardous chemicals under conditions typical of a given industry over a working lifetime. Despite finding over 100 chemicals associated with increased incidence of disease, convincing dose-response trends existed for only a few. Although there were notable exceptions (arsenic, asbestos, PAH's, etc.), it was generally impossible to estimate risk-per-unit of dose in a manner analogous to calculations which exist for radiation exposure. In addition to analyzing risk in terms of increased incidence of specific diseases, we also examined life expectancy and years of life lost due to cancer in four selected occupational groups via a life table model which allowed for competing risks. The resulting estimates indicated that the overall life expectancy of these groups was generally greater than that of the general population but that the workers suffered greater loss of life expectancy (LLE) due to cancer than their counterparts in the general population. Published estimates of LLE due to radiation induced cancer indicate that at doses of 0.5 rem/y, radiation workers are projected to suffer less LLE than any of the four non-nuclear cohorts examined. At 5 rem/y (the MPD) or higher, LLE may be greater than one or more of the cohorts examined. This is Volume III of a three volume series. This volume provides documentation of adverse effects of exposure to over 75 chemicals for which occupational standards have been proposed by the National Institute for Occupational Safety and Health (NIOSH). 77 references.

56516 **(ORNL/TM—8821) Biomedical response to products and effluents from the University of Minnesota-Duluth gasifier.** Epler, J.L.; Fry, R.J.M.; Rao, T.K.; Larimer, F.W.; Dumont, J.N.; Schultz, T.W.; Russell, L.B.; Generoso, W.M.; Witschi, H.; Smith, L.H. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 68p. NTIS, PC A04/MF A01. Order Number DE84000649.

Electrostatic precipitator tars from the UMD gasifier were found to be mutagenic in the Salmonella/microsome assay and were confirmed in the yeast assay. After chemical fractionation of the ESP tars, it was found that the mutagenic activity was contributed principally by the organic constituents of the basic fraction, and only secondarily by constituents of the neutral fraction. The ESP tars occupy a position intermediate to the low-activity petroleum crude oils and the relatively higher-activity coal-derived liquids, with respect to mutagenic potential. Aqueous extracts of ESP tar were embryotoxic and teratogenic in the amphibian system. Distilled water leachates of bottom ash were both embryotoxic and teratogenic in the amphibian system. ESP tar caused decreased postnatal survival, cytotoxicity, and some teratogenicity coincident to the mouse spot test, but there was no evidence of mutation induction. ESP tar caused transient loss of reproductive capacity in mice. There was a detectable increase in dominant-lethal mutations at all stages in spermatogenesis. ESP tars were slightly toxic to mice when given orally. Moderate toxicity was noted following intraperitoneal injection. Tar samples caused moderate, albeit reversible, eye irritation. The data obtained in the mouse lung adenoma bioassay indicate that ESP tar is tumorigenic. ESP tar is carcinogenic mouse skin. 10 references.

56517 **(UCRL—89013) Modeling SO_2 effects on the productivity and growth of plants.** Kercher, J.R.; King, D.A. (Lawrence Livermore National Lab., CA (USA)). Jan 1983. Contract W-7405-ENG-48. 37p. (CONF-831102—1). NTIS, PC A03/MF A01. Order Number DE83010259.

From Conference on effects of SO/sub 2/ on plant productivity; Palo Alto, CA, USA (28 Nov 1983).

The purpose of this paper is to describe the relatively few models which have been constructed for predicting or analyzing effects of sulfur dioxide on the productivity and growth of individual plants. The goal is to define growth models; describe the types of such models; and review the work to date on the various types. Current approaches being used and their utility for various problems are assessed.

56518 **Cytotoxicity of nitroaromatic hypoxic cell radiosensitizers on mammalian cells in vitro.** Horsman, M.R. London, England; London University (1980). 241p. British Library, Boston Spa, Wetherby, West Yorks. No. D70033/81.

Thesis.

The cytotoxic action of several representative nitroaromatic compounds towards Chinese hamster V79 cells in vitro was investigated. Particular reference is made to the 2-nitroimidazole, misonidazole. The results showed that compounds, which are likely to affect the rate and extent of reduction of the nitro group, can alter the cytotoxicity of nitroaromatic compounds under hypoxic conditions. Inhibition of oxygen utilization in aerobic cells by respiratory inhibitors can be relieved by the addition of misonidazole. The presence of these inhibitors or exogenous compounds which can act

as energy sources, can change the survival response of mammalian cells to misonidazole both aerobic and hypoxic conditions. Post-incubation of cells in caffeine after exposure to either misonidazole, metronidazole or nitrofurantoin accentuates the degree of cell-killing, probably by inhibition of repair of DNA damage. Several of these nitroaromatic compounds are weakly mutagenic, as demonstrated by resistance to the toxic action of Ouabain and Thioguanine. The mechanistic implications of these results and the relevance to the use of these compounds in cancer therapy are discussed.

56519 **Interaction of hyperthermia with the cytotoxicity of electron-affinic radiosensitizers - in vitro.** Rajaratnam, S. London, England; London University (1980). 190p. British Library, Boston Spa, Wetherby, West Yorks. No. D70082/81.

Thesis.

The interaction of hyperthermia with the differential toxicity of electron-affinic radiosensitizers has been investigated. This differential cytotoxicity is enhanced by modest hyperthermia and the greatest thermal enhancement occurs with the compound with the lowest electron affinity. This is consistent with the proposal that the mechanism of toxicity involves a reduced product and the activation energy for the reduction process decreases with increasing electron affinity. The effect of low extracellular pH in modifying the thermal enhancement of cytotoxicity has also been studied. Preincubation with electron-affinic radiosensitizers in anoxia at 37°C prior to heating removes the shoulder and increases the slope of the hyperthermic survival curve, even when heating is done in the absence of the drugs. This has been studied for three different subpopulations (chronically hypoxic cells, thermotolerant cells, plateau phase cells), all of which are thermotolerant and their different response to pretreatment is discussed in terms of the mechanisms of the interactive effect. In addition to the use of cell lethality as an end-point, a study was made of the effect of radiosensitizers on other possible molecular targets of their lethal action, e.g. DNA strand breaks.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 56519

57 HEALTH AND SAFETY

56520 **(MSHA/IR—1129) Noise in the mining industry. An overview.** Giardino, D.A.; Marraccini, L.C. (Mine Safety and Health Administration, Pittsburgh, PA (USA). Pittsburgh Health Technology Center). 1981. 12p. NTIS, PC A02/MF A01. Order Number DE83903009.

This paper surveys noise levels, noise exposure patterns, and frequency spectra found in the mining environment; the effects of mining noise on the working population; and the quantification of hearing loss in the coal mining industry. Federal mining noise regulations and the present state of the industry, with respect to noise control technology, are discussed. Examples of proven noise controls for mining are included along with measured noise reductions.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 55464, 55509, 55542, 55544, 55547, 56343, 56354, 56355, 56356, 56357, 56358, 56359, 56360, 56361, 56362

56521 **(BM-IC—8869) Critical and strategic minerals in Alaska. Cobalt, the platinum-group metals, and chromite.** Barker, J.C.; Still, J.C.; Mowatt, T.C.; Mulligan, J.J. (Bureau of Mines, Fairbanks, AK (USA). Alaska Field Operations Center; Bureau of Mines, Juneau, AK (USA). Alaska Field Operation Center). 1981. 17p. GPO.

A uniquely mineralized area extends from northwestern Canada through Alaska into eastern Siberia. Some of the metals found there are relatively rare in the conterminous United States. Among these are cobalt, the platinum-group metals, and chromite. Geologic evidence suggests that cobalt and the platinum-group metals may be present in deposits that could constitute nationally important reserves. Chromite in potentially minable deposits is known, but it may be relatively less abundant. Limited reserves of these metals have been delineated, but most of the favorable terranes and reported occurrences throughout the vast expanse of Alaska remain unexplored. As part of the mineral studies mandated under the Alaska National Interest Lands Conservation Act, this first in a series of annual reports summarizes available information about deposits and past production of cobalt, the platinum-group metals, and chromite, and describes current and planned Bureau investigations of these minerals. 21 references.

56522 **(N—8324921) Geological studies of the COST Nos. G-1 and G-2 wells, United States North Atlantic Outer Continental Shelf.** Scholle, P.A.; Wenkam, C.R. (Geological Survey, Washington, DC (USA)). 1982. 202p. (USGS-CIRC—861). NTIS, PC A09/MF A01.

Core sampling and multichannel seismic reflection investigations of the Georges Bank basin are reported. Maps, charts, and graphs summarize results of studies of the lithology, stratigraphy, paleoenvironments, and deposition cycles. Organic geochemical analysis, calculation of basin subsidence, and geomagnetic and magnetic anomaly locations are included.

56523 (NP—3770386, pp 3-19) **Development of bio-engineering measures in aquatic landscape engineering.** Kemmerling, W. 1982. (In German). NTIS (US Sales Only), PC A12/MF A01.

In Ecology of running waters - bio-engineering safeguarding measures.

Both exemplary and fundamental description of the development of bio-engineering measures in aquatic landscape engineering in the course of history. Recognition of the necessity of bio-engineering measures. Existence of insight into and possible realisations of water body regulation oriented to nature and landscape and based on scientific, empirical and partially experimentally proven findings.

56524 **(PNL-SA—11537) Transport Assessment - Arid Task: model verification studies - FY 1983. Annual report.** Jones, T.L.; Kirkham, R.R.; Gibson, D. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 15p. (CONF-8308106—7). NTIS, PC A02/MF A01. Order Number DE84000121.

From 5th. annual participants information meeting of DOE low level waste management program; Denver, CO, USA (30 Aug 1983).

The current focus of the Transport Assessment- Arid Task is the evaluation of evaporation and transpiration submodels used in water flow models. Models will be evaluated by how accurately they simulate field water balance data. To date we have: (1) selected four evaporation models to be tested, (2) constructed an evaporation test case, and (3) started collection of data for a transpiration test case. Evaluation of the evaporation models will be completed during FY83, with results published in September. The evaporation test case contains data describing soil water content, water storage, as well as drainage rates observed in the unvegetated lysimeters of the BWTF. For example, data show deep drainage accounted for 8% of the natural precipitation, but rose to 25% after irrigation doubled total precipitation. This year, deep drainage was also observed in vegetated soils. These results refute a commonly held assumption that evapotranspiration eliminates deep drainage in arid soils.

56525 **(UCID—19880) Kriging of geological and physical parameters from Yucca Flat, NTS.** Mao, N.H. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 77p. NTIS, PC A05/MF A01. Order Number DE83018227.

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We applied kriging to various geological and physical parameters from Yucca Flat at the Nevada Test Site. The uncertainty of an estimate for the depth to the tuff-pre-Cenozoic rock contact is about 81 m and for the depth to the alluvium-tuff contact is about 38 m. Physical parameters of mixed alluvium were kriged and

showed some systematic variations. The results for bulk density and grain density are better than those for the water content and CO_2 content. Various approaches to improve the estimates are outlined. By using digitized topographic data, we tested the performance of kriging. The test revealed that the results from the kriging validation process were a fair representation of the overall uncertainty. An empirical equation was proposed to calculate the estimated uncertainty from the data variance and number of data points. The calculated uncertainty values for the depths to the tuff pre-Cenozoic rock contact and alluvium tuff contact are 80 m and 39 m respectively. These values are in excellent agreement with the kriged results. 14 references, 36 figures, 7 tables.

56526 **Surface chemistry and dissolution kinetics of glassy rocks at 25°C.** White, A.F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Geochimica et Cosmochimica Acta;* 47: No. 4, 805-815(Apr 1983).

The weathering rates and mechanisms of three types of glassy rocks were investigated experimentally at 25 deg C, pH 1.0 to 6.2, and reaction times as much as to 3 months. Changes in major element chemistry were monitored concurrently as a function of time in the aqueous solution and within the near surface region of the glass. Leach profiles, obtained by a HF leaching technique, displayed near-surface zones depleted in major cations. These zones increased in depth with increasing time and decreasing pH of reactions. Release rates into the aqueous solution were parabolic for Na and K and linear for Si and Al. A coupled weathering model, involving surface dissolution with concurrent diffusion of Na, K, and Al, produced a mass balance between the aqueous and glass phases. Steady state conditions are reached at pH 1.0 after approximately 3 weeks of reaction. Steady-state is not reached even after 3 months at pH 6.2. An interdiffusion model describes observed changes in Na diffusion profiles for perlite at pH 1.0. The calculated Na self-diffusion coefficient of 5×10^{-19} $cm^2 s^{-1}$ at 25 deg C approximates coefficients extrapolated from previously reported high temperature data for obsidian.

5802 Geophysics

REFER ALSO TO CITATION(S) 55457

56527 **(AD-A—127477/8) Deterministic methods of seismic source identification. Annual technical report No. 4, 1 Oct 81-30 Sep 82.** Archambeau, C.B. (Cooperative Inst. for Research in Environmental Science, Boulder, CO (USA)). Feb 1983. 183p. NTIS, PC A09/MF A01.

This report emphasizes results from completed research in seismic wave attenuation. We also describe and illustrate current signal analysis methods using a variety of seismic time series data. The results reported include relative amplitudes, at a large number of standardized seismic stations in the U.S. and Southern Canada, for a large number of explosions and earthquakes observed at three fixed azimuths for many stations. The average Qa at 1 Hz, for the upper 300 km of the crust-mantle beneath the study area varies from about 65 at Golden, Colorado to about 2000 at Red Lake, Ontario. The mean Qa is 140 for the continental U.S. Other work completed has provided new, high resolution, Q determinations from low order free oscillation excitation, and these results provide strong constraints on lower mantle attenuation. We describe new signal analysis methods devised for use in automatic discrimination and yield estimation in a multivariant approach. In this context we have the current ability to rapidly and automatically obtain spectral magnitudes for a large number of seismic phases, which can be used in both teleseismic and regional discrimination and for yield estimation.

56528 **(LA—9840-MS) Nevada Test Site seismic: telemetry measurements.** Albright, J.N.; Parker, L.E.; Horton, E.H. (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 38p. NTIS, PC A03/MF A01. Order Number DE84000447.

The feasibility and limitations of surface-to-tunnel seismic telemetry at the Nevada Test Site were explored through field measurements using current technology. Range functions for signaling were determined through analysis of monofrequency seismic signals injected into the earth at various sites as far as 70 km (43 mi) from installations of seismometers in the G-Tunnel complex of Rainier Mesa. Transmitted signal power at 16, 24, and 32 Hz was measured at two locations in G-Tunnel separated by 670 m (2200 ft). Transmissions from 58 surface sites distributed primarily along three azimuths from G-Tunnel were studied. The G-Tunnel noise environment was monitored over the 20-day duration of the field tests. Noise-power probability functions were calculated for 20-s and 280-s seismic-record populations. Signaling rates were calculated for signals transmitted from superior transmitter sites to G-Tunnel. A detection threshold of 13 dB re 1 nm^2 displacement power at 95% reliability was demanded. Consideration of field results suggests that even for the frequency range used in this study, substantially higher signaling rates are likely to be obtained in future work in view of the present lack of information relevant to hardware-siting criteria and the seismic propagation path at the Nevada Test Site. 12 references.

56529 **(NUREG/CR—3327) Analysis of strong-motion data from the New Hampshire earthquake of 18 January 1982.** Chang, F.K. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Geotechnical Lab.). Sep 1983. 75p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84900067.

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This report provides a permanent record and presents an analysis of the strong-motion data from the New Hampshire earthquake of 18 January 1982 which occurred at latitude 43.5 degrees N. longtitude 71.6 degrees W. Thirty-six accelerograms were recorded and digitized. The raw digitized accelerograms were processed by the US Geological Survey, Seismic Engineering Branch, to provide baseline correction and integrals are presented in tabular and graphic form. The integrated velocities and displacements are presented in graphic form. The attenuation curves of the three orthogonal components for peak acceleration, peak velocity, peak displacement, and velocity spectrum intensity on the crest, abutment, and downstream sites of the five US Army Corps of Engineers earth dams were plotted and compared. The transverse component shows the highest energy at the Franklin Falls Dam. However, its attenuation rate is faster than the vertical and longitudinal components. The transverse component of the accelerograph located on the right abutment of Franklin Falls Dam (8 km from the epicenter) recorded a maximum acceleration of 0.55 g's, which is the highest acceleration ever recorded in the eastern United States. The integrated maximum velocity is 5.59 cm/sec, which is very low in comparison with other earthquake records in the western United States or other earthquake regions. 8 references, 6 figures, 3 tables.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 55461, 55462, 55464, 55534, 55535, 55543

56530 **(SAND—83-2053C) Integrated real-time fracture-diagnostics instrumentation system.** Engi, D. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-8310162—2). NTIS, PC A02/MF A01. Order Number DE84000454.

From Western gas sands sub-program review meeting; Morgantown, WV, USA (18 Oct 1983).

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The use of an integrated, real-time fracture-diagnostics instrumentation system for the control of the fracturing treatment during massive hydraulic fracturing is proposed. The proposed system consists of four subsystems: an internal-fracture-pressure measurement system, a fluid-flow measurement system, a borehole seismic system, and a surface-electric-potential measurement system. This use of borehole seismic and surface-electric-potential measurements, which are essentially away-from-the-wellbore measurements, in conjunction with the use of the more commonly used types of measurements, i.e., at-the-wellbore pressure and fluid-flow measurements, is a distinctive feature of the composite real-time diagnostics system. Currently, the real-time capabilities of the individual subsystems are being developed, and the problems associated

with their integration into a complete, computer-linked instrumentation system are being addressed. 2 figures.

56531 **Aggregation of clay particles as indicated by indirect transforms of small-angle scattering data.** Dwiggins, C.W. Jr. (Dept. of Energy, Bartlesville, OK). *Journal of Applied Crystallography*, **15**: 564-566(1982).

Clays prepared by sedimentation from aqueous suspension were shown to contain aggregates much larger than individual clay particles. Small-angle x-ray scattering data were obtained with an automated Bonse-Hart instrument. The distance distribution functions for the clay aggregates were obtained using the Glatter indirect Fourier transform method. The distance distribution function extended to over 200,000 A, and the average radius of gyration was over 50,000 A in the most extreme cases.

5804 Geochemistry

REFER ALSO TO CITATION(S) 55464, 55540, 55545, 55838, 56120, 56123, 56264, 56265, 56266, 56364

56532 **(CONF-8309151—1) Behavior of traces of refractory minerals (including monazite) in the lithium metaborate fusion.** Feldman, C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84000259.

From Labcon central '83 conference; Chicago, IL, USA (19 Sep 1983).

In the analysis of rocks using the $LiBO_2$ fusion - acid dissolution procedure, traces of various elements may escape detection if the minerals in which they occur resist fusion, or are converted by the fusion to some form that is insoluble in the quenching liquid used. To check for such behavior, 20 to 100 mg samples of 12 chemically resistant minerals were fused. Nine (cassiterite, ilmenite, rutile, wolfamite, magnetite, zircon, corundum, beryl, columbite-tantalite) gave melts which dissolved to give clear, stable solutions in 3% HNO_3 containing, in some cases, appropriate additives. Chromite produced a chromium carbide which could not be dissolved, but whose formation could be prevented by including $NaBO_3$ in the fusion mixture. The melt obtained with monazite required 6N HCl for dissolution. Molybdenite (MoS_2) was not attacked by any of the fusions tried.

64 PHYSICS RESEARCH

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 55843, 56283, 56605, 56674, 56698

56533 **(AD-A—127514/8) Net effect of many gravitational fields on the intensity of celestial light sources. Master's thesis.** Cipperly, G.E. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1982. 123p. (AFIT/GEP/PH—82D-4). NTIS, PC A06/MF A01.

This thesis investigates the lens-like action of the gravitational fields of celestial bodies, which can alter the apparent intensity of more distant sources. Previous work in this area has shown that the chance of an individual body being sufficiently well aligned with a source to cause a very large gravitational intensity change is small. The issue addressed in this study is the possibility of there being a significant total change in the intensity of a source due to the combined effects of the gravitational fields of all celestial bodies, and in particular, the potential impact on intensity distance measurements, that is, determination of the distances of celestial light sources by means of intensity comparisons. It is first shown that the problem can be treated in flat space by associating an appropriate index of refraction with gravitational fields. A wave approach is taken in deriving the total deflection of a ray by the field of a single point mass. A statistical analysis is then performed to determine the expression for the mean total change in the intensity of celestial light sources due to the combined fields of all intervening bodies.

56534 **(AD-A—127652/6) Comparison of heliospheric current sheet structure obtained from potential magnetic field computations and from observed polarization coronal brightness.** Wilcox, J.M.; Hundhausen, A.J. (Stanford Univ., CA (USA). Inst. for Plasma Research). Feb 1983. 19p. (SU-IPR—953). NTIS, PC A02/MF A01.

The report compares the structure of the heliospheric current sheet early in Sunspot Cycle 21 as computed from the observed photospheric magnetic field with a potential field approximation, and as inferred from synoptic maps of the observed coronal polarization brightness. On most of the solar rotations compared, the two methods give essentially the same results; the basic shape of the warped current sheet and the amplitude (in solar latitude) of the displacements of the sheet from the solar equator are similar. On one rotation the current sheet computed with the potential field approximation appears to be distorted by a large photospheric region of unbalanced magnetic flux.

56535 **(AD-A—128046/0) Alfven waves in the solar wind in association with solar energetic particles: sunspot umbral origin. Final report 1 Oct 80-31 Mar 83.** Mullan, D.J.; Owens, A.J. (Bartol Research Foundation, Swarthmore, PA (USA)). 4 Feb 1983. 89p. NTIS, PC A05/MF A01.

We report on a search for Alfven waves in the solar wind during solar particle events. During the period June 6-8, 1979, we find clear signatures of outgoing Alfven waves which could have been released from the sun simultaneously with the initial release of energetic particles. The waves are soliton-like, with durations of 200-900 seconds. An isolated square Alfven solution is also seen when the first particles (with E approximately 57 MeV) are detected: the width of this solution is approximately 950 seconds. A series of five small amplitude spikes in the magnetic field are also seen, preceding the arrival of the first particles by a few hours. The spikes are separated by intervals of 854 + or - 20 seconds. We suggest that these periodicities are determined by conditions at the sun. The features which we have detected are consistent with Alfven waves released from the umbra of a sunspot during a flare.

56536 **(DOE/ET/53088—94) Loop coalescence in flares and coronal x-ray brightening.** Tajima, T.; Brunel, F.; Sakai, J. (Texas Univ., Austin (USA); High Altitude Observatory, Boulder, CO (USA)). May 1983. Contract FG05-80ET53088. 15p. NTIS, PC A02/MF A01. Order Number DE83013070.

Characteristics of solar flares such as their impulsive nature, time scale, heating, high-energy-particle spectrum, γ-ray oscillations as well as recent x-ray photographs of coronal brightening are explained by the nonlinear coalescence instability of current loops.

56537 (INIS-mf—8474, pp 53-68) **Solar neutrino problem.** Zatsepin, G. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij:. 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The problem of missing solar neutrinos is reviewed and discussed. The experiments of the 70s show a solar neutrino flux to be 4 times lower than the flux predicted by the standard model of the Sun. The three possible origins of this contradiction are analysed: the cross sections of nuclear reactions going on in the internal region of the Sun must be remeasured; the unknown properties of neutrino, like neutrino oscillation or decay, must be investigated theoretically and experimentally; or the standard model of the Sun must be changed, e.g. by a periodically pulsating star model or by a model describing periodic admixtures of He-3 to the central region of the Sun. Some new models and newly proposed experiments are described. The importance of new electronic detection methods of neutrinos is underlined.

56538 (INIS-mf—8474) Proceedings of the international conference Neutrino '82, Balstonfuered, Hungary, 14-19 June 1982. Frenkel, A.; Janik, L. (eds.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Eoetvoes Lorand Fizikai Tarsulat, Budapest (Hungary)). 1982. 195p. (CONF-820675—Vol.3). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780001.

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

56539 (KFK—3451) s-process chronometers. Beer, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik). Jan 1983. 17p. (CONF-8210155—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751002.

From Workshop on problems of nuclear astrophysics; Mainz, F.R. Germany (13 Oct 1982).

The radionuclei ^{40}K, ^{81}Kr, ^{87}Rb, ^{93}Zr, ^{107}Pd, ^{147}Sm, ^{176}Lu and ^{205}Pb are built up totally or partially by the s-process. Due to their long half life they are potential chronometers for the age and the development of the s-process. The usefulness of the various nuclei is discussed. For the determination of the mean age of the s-process synthesis and with it the age of the galaxy, ^{176}Lu is best suited. It is demonstrated that this age can be calculated solely from measured cross section and abundance ratios. Various effects which can limit the usefulness of ^{176}Lu as a clock are discussed.

56540 (LA-UR—83-2329) Review of astrophysical research at Los Alamos. Kirkpatrick, R.C. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 7p. (CONF-8305133—1). NTIS, PC A02/MF A01. Order Number DE83017304.

From Southwest regional conference on astronomy and astrophysics; Fort Davis, TX, USA (13 May 1983).

A brief summary is given of astrophysics research activities at Los Alamos. (GHT)

56541 (N—8322078) The evolution of structure in the universe from axions. Stecker, F.W.; Shafi, Q. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Dec 1982. 13p. (NASA-TM—84963). NTIS, PC A02/MF A01.

A scenario where axions provide the dark matter in the universe is considered. Fluctuations in the axion field density produced by domain walls and strings cause the appearance of 'axion clumps' of masses of order 10 to the 6th power solar mass which most likely collapse to black holes by or at the time that the universe becomes axion dominated at T is approximately 10 eV. These objects form the building blocks for a clustering hierarchy theory of galaxy and supercluster formation on scales up to approximately 10 Mpc and approximately 10 to the 15th power solar mass.

56542 (N—8322079) Mass loss from early-type stars. Conti, P.S. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). 1982. 14p. NTIS, PC A02/MF A01.

Stellar winds are observed in hot and luminous stars of all types. The evidence for the winds comes from observations of P Cygni profiles of resonance lines of highly ionized common species, from emission lines of highly excited ions, and from free-free radiation from the electrons in the outflowing material. Stellar winds have as their dominant origin the radiation pressure in the ultraviolet lines coupling momentum to the wind as a whole. It was found that for the most luminous OB stars, in which the winds can readily be detected, the mass loss rate is proportional to the luminosity, L, to a power alpha, where alpha is of the order of 1.7. This relation carries over four orders of magnitude in the mass loss rates. This relation also continues to the lower luminosity giant and main sequence B type stars. By contrast, the mass loss rates for the enigmatic Wolf-Rayet (W-R) stars, which have among themselves vastly different spectra, luminosities, and masses are similar.

56543 (N—8322084) The flux and source of energetic protons in Saturn's inner magnetosphere. Schardt, A.W.; Mcdonald, F.B. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Dec 1982. 59p. (NASA-TM—84938). NTIS, PC A04/MF A01.

The flux of energetic protons in Saturn's inner magnetosphere was observed in two channels from 48 to 63 and 63 to 160 MeV. Absorption features due to the G ring and the satellites Enceladus and Mimas were easily identifiable. The flux observed in the absorption slot of Mimas can be maintained by the decay of a cosmic ray albedo neutron flux of 0.007/sq cm/s/sr. This flux is entirely consistent with calculations of the neutron flux produced by galactic cosmic ray interactions with the rings of Saturn. The omnidirectional proton flux of 0.0082/sq cm/s at 2.734 R sub s requires a residence time of 30 years. Both the residence time and the energy spectrum are comparable to those found in the inner radiation belt of the Earth. The angular distribution is nearly isotropic in the Mimas slot and beyond 4R sub s. Otherwise the pitch angle distribution is pancake and is approximated by sin(n)theta with n in the range 2 to 7. This distribution is consistent with an isotropic neutron source in the ring plane.

56544 (N—8322088) Active galaxies and the diffuse Gamma-Ray background. Kazanas, D.; Protheroe, R.J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Feb 1983. 14p. (NASA-TM—84974; REPT—665). NTIS, PC A02/MF A01.

A model for the origin of relativistic particles and gamma rays in active galactic nuclei and quasars, together with recent HEAO-1 observations of the spectra of active galaxies from 2 to 165 keV, provide the basis for a reexamination of the nature of the extragalactic gamma ray background. Active galaxies account for the observed background if their X-ray spectra steepen to E.021 above 100 keV, as observed in Cen-A, together with a further steepening to E.021 as a result of absorption of gamma rays by photon-photon pair production interactions with X-ray photons. The compactness of active galaxies required to give this steepening is consistent with estimates of their typical luminosity and radius.

56545 (N—8323253) Accretion instability models for Dwarf Novae and X-ray transients. Cannizzo, J.K.; Wheeler, J.C.; Ghosh, P. (Texas Univ., Austin (USA)). 1982. 9p. (NASA-CR—170177). NTIS, PC A02/MF A01.

Steady state and time dependent calculations of a model for accretion instability are presented, in which matter accumulates in a cold torus and then undergoes a thermal instability causing the matter to heat and flow down onto the central star. The model is compared to the observations of dwarf novae and certain examples of both hard and soft X-ray transients.

56546 (N—8323266) Cosmic-ray modulation and the anamalous component. Jones, F.C. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Mar 1983. 30p. (NASA-TM—84994; REPT—665). NTIS, PC A03/MF A01.

Advances in the theory and observation of cosmic ray modulation and in studies of the anomalous component in cosmic radiation are reviewed from reports that appeared in the open literature during the years 1979 to 1982. Entries, which are primarily the work of American researchers, are cited under the following categories: (1) microscopic diffusion theory (2) global modulation theory (3) anomalous component and (4) general modulation observation.

56547 (N—8324830) Liquid helium management for Gravity Probe-B. Schafer, C. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Dec 1982. 36p. (NASA-TM—82521). NTIS, PC A03/MF A01.

The Gravity Probe-B (GP-B) experiment will be degraded if accelerations at a proof mass become larger than one ten billionth g. This makes necessary the management of the configuration and dynamical behavior of the large amount of liquid helium present in

the GP-B spacecraft dewar. Three approaches to the solution of this problem are discussed. It is concluded that the most promising technique involves the use of baffles into which the liquid helium can be forced during a relatively high spacecraft rotation period, and in which the liquid helium will be held by capillary forces during the operational period when the rotation rate is much lower. Some likely baffle configurations are suggested.

56548 **(PB—83-204206) Space plasma physics: the study of solar-system plasmas. Volume 1. Reports of the study committee and advocacy panels.** (National Academy of Sciences, Washington, DC (USA). Assembly of Mathematical and Physical Sciences). 1978. 107p. NTIS, PC A06/MF A01.

This is the first volume of a study which attempts to identify the future objectives of research in space plasma physics. Plasma is matter in the ionized state. Space plasma physics concerns the study of plasmas in the space environment. The principal conclusions are: (1) Space plasma physics is intrinsically an important branch of science. (2) Now that the initial exploratory state of space plasma physics has been completed successfully, the fruitfulness of future projects will depend on addressing basic scientific problems. (3) The theoretical component of the space-plasma effort needs to be strenthened by increased support and by encouraging theory to play a central role in the planned development of the field.

56549 **(PB—83-204214) Space plasma physics: the study of solar-system plasmas. Volume 2. Working papers. Part 1. Solar-system magnetohydrodynamics.** (National Academy of Sciences, Washington, DC (USA). Assembly of Mathematical and Physical Sciences). 1979. 774p. NTIS, PC A99/MF E04.

This is the second volume of a study which attempts to identify the future objectives of research in space plasma physics. This is the report of the Panel on Solar System Magnetohydrodynamics. Solar-system magnetohydrodynamics treats large-scale plasma phenomena in the solar wind and at the planets. Papers include: The solar wind and related astrophysical phenomena; the interactions of energetic particles with the solar wind; hydromagnetic waves and turbulence in the solar wind; earth's magnetosphere: global problems in magnetospheric plasma physics; Jupiter's magnetosphere and radiation belts; towards a comparative theory of magnetospheres; magnetosphere, ionosphere, and atmosphere interactions.

56550 **Modeling in chaotic relativity.** Zardecki, A. (Theoretical Division, MS-B279, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] D: Particles and Fields;* **28**: No. 6, 1235-1242(15 Sep 1983).

The chaotic behavior of solutions to Einstein's equations has recently been studied by Barrow within the framework of the dynamical systems theory. Barrow's program of gravitational turbulence is implemented in part by considering the solutions of type VII_0 and IX as well as some intermediate types. Quantitative measures of chaos, such as the power spectrum and Lyapunov characteristic exponent, are computed. By converting the equations of motion for the cosmic scale factors to stochastic Langevin's equations, the Mixmaster cosmology in the presence of driving noise terms is investigated. Possible sources of noise can be attributed to an imperfect cancellation of the effective vacuum energy density and the energy density associated with the Higgs field. An ensemble average over random trajectories leads to the suppression of chaotic behavior for type-IX cosmology.

56551 **Neutron-capture cross sections for osmium isotopes and the age of the Universe.** Berman, B.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Comments on Nuclear and Particle Physics;* **11**: No. 2, 63-78(Feb 1983).

The neutron-capture cross sections for the light osmium isotopes ^{186}Os and ^{187}Os recently have been measured in the energy range up to 150 keV. The knowledge of these cross sections enables us to calibrate the $^{187}Re \rightarrow ^{187}Os$ nuclear β-decay clock and thus to make a new radiogenic determination of the age of the Universe. The value thus determined, with certain assumptions, is 17 +- 3 billion years. This value, larger than had been believed heretofore, is in accord with the age of recently discovered galaxies; however, it exceeds the most recent determination of the Hubble time, with important cosmological implications.

6402 Atmospheric Physics

56552 **(LA—9814-MS) Propagation of a radio-frequency pulsed signal over the earth. The Jolly programs.** Carroll, D.; Detch, J.L.; Malik, J. (Los Alamos National Lab., NM (USA)). Jul 1983. Contract W-7405-ENG-36. 76p. NTIS, PC A05/MF A01. Order Number DE84000109.

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The interpretation of observed radioflash/electromagnetic pulse (emp) observed signals from nuclear detonations in terms of theoretical models or extrapolation to signals expected at military systems involves correction for ground-wave propagation effects. For most applications, previously developed programs have been adequate. There have been problems when these techniques have been tried for situations in the near tangent regime whwere a considerable concern exists. It has been found that the problem of predicting propagation response functions in the near tangent regime has been the inconsistent derivation of the equations. Resolution of this problem has evolved into a program to better predict ground-wave propagation. The description of the method and detailed description of the programs are described for both propagation over realistic earth and sea-water paths. Results can be given in terms of amplitude and phase as a function of the frequency or as amplitude versus time, the usual Green's or resolution function.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 55843

56553 **(CONF-830449—4) Autoionization spectra of He excited by fast (MeV) H^+, He^+, and Li/sup n/$^+$ (N = 1,2,3) ions.** Schneider, D.; Arcuni, P.; Bruch, P.; Stoeffler, W. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01. Order Number DE83017956.

From DOE contractors workshop; Oak Ridge, TN, USA (21 Apr 1983).

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Autoionization spectra of He following excitation by 1 to 3 MeV H^+, He^+, and Li/sup n/$^+$ (n = 1,2,3) have been measured as a function of observation angle. The $(2p^2)^1D$ and $(2s2p)^1P$ resonances have been examined and a strong dependence on projectile velocities, charge state and observation angle was found. The measurements were performed in a crossed-beam scattering chamber. The target-gas pressure was in the order of 10^{-4} Torr. The secondary electrons have been energy analyzed by a 45° parallel-plate analyzer. Results are presented and discussed. (WHK)

56554 **(CONF-830706—7) Introduction: advances and opportunities in cluster research.** Castleman, A.W. Jr. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1983. Contract AC02-82ER60055. 13p. NTIS MF A01. Order Number DE84000364.

From 13. international conference on the physics of electronic and atomic collisions (ICPEAC); Berlin, F.R. Germany (27 Jul 1983).

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Examples of neutral and ionic clusters include these in the upper and lower atmosphere, interstellar grain formation, combustion, radiation physics and chemistry, surface bombardment, fission product transport in reactors, corrosion, etc. This paper is a brief overview of some recent developments in cluster research. (DLC)

56555 **(CONF-830920—9) Ionization phenomena and sources of negative ions.** Alton, G.D. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE84000684.

From 7. symposium on sources and ion assisted technology and 4. international conference on ion and plasma assisted techniques; Kyoto, Japan (12 Sep 1983).

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Negative ion source technology has rapidly advanced during the past several years as a direct consequence of the discovery of Krohn that negative ion yields can be greatly enhanced by sputtering in the presence of Group IA elements. Today, most negative ion sources use this discovery directly or the principles implied to effect negative ion formation through surface ionization. As a consequence, the more traditional direct extraction plasma and charge exchange sources are being used less frequently. However, the charge exchange generation mechanism appears to be as universal, is very competitive in terms of efficiency and has the advantage in terms of metastable ion formation. In this review, an attempt has been made to briefly describe the principal processes involved in negative ion formation and sources which are representative of a particular principle. The reader is referred to the literature for specific details concerning the operational characteristics, emittances, brightnesses, species and intensity capabilities of particular sources. 100 references.

56556 **(CONF-8308112—3) Studies of ions in a drift field: laser diagnostics of excited states and measurements of thermochemical properties at equilibrium.** Castleman, A.W. Jr.; Keesee, R.G. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1983. Contract AC02-82ER60055. 9p. NTIS, PC A02/MF A01. Order Number DE84000363.

From 3. international Swarm seminar; Innsbruck, Austria (3 Aug 1983).

Portions are illegible in microfiche products.

A major technique for investigating the thermochemical properties of ions and their related clusters is the high pressure drift/mass spectrometer detection technique. A crucial question in this regard is the extent to which ions drifting in an electric field are thermalized. This paper is divided into two parts, one describing some laser techniques which are enabling an investigation of the possible presence of excited ions in a drift field, and secondly, a reporting of some recent findings and trends in the stability of ion clusters of single and mixed constituents.

56557 **(DOE/ER/10464—4) Photo-induced field emissions from metallic surfaces. Final report.** Reifenberger, R. (Purdue Univ., Lafayette, IN (USA)). Sep 1983. Contract AC02-79ER10464. 12p. NTIS, PC A02/MF A01. Order Number DE84000872.

Photo-induced field emissions is a technique which studies electrons that have been photoemitted from small sub-micron metallic surfaces. This experimental method promises to combine the proven utility of both field emission and photoemission for investigating the electronic states near a metal surface. Photon energies in the blue and near UV regions of the electromagnetic spectrum where employed throughout this study. The primary objective of the research performed during the prior contract period was to measure both the final state energy distributions and electric field dependence of the external photocurrent at energies below threshold.

56558 **(DOE/ER/10609—15) Electron collisions with positive ions. Progress report, April 1, 1983-March 31, 1984.** Henry, R.J. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). Sep 1983. Contract AS05-80ER10609. 8p. NTIS, PC A02/MF A01. Order Number DE84000835.

Inelastic electron impact collision strengths were calculated for Mg^+ from the 3s ground state to excited states, 3p, 4s, 3d and 4p in a five-state close coupling approximation for the electron impact energy range $15 < E < 1000$ eV, and for excitation of Al^{++} from the 3s to 3p state in a two-state close coupling approximation for the electron impact energy range $15 < E < 400$ eV. Accurate target functions were used in the expansion. In addition, cascade contributions added 20 to 40% to the total excitation cross section for the 3p level of Mg^+, and less than 5% for Al^{++}. While our manuscript has been completed, submission will be delayed until a companion paper on the experiments is prepared. Differential cross sections for excitation of Zn^+ from the 4s ground state to the 4p excited state were calculated at energies between 15 and 100 eV in a five-state close coupling approximation in which the 4s, 4p, $3d^94s^2$, 5s and 4d states were included. We used the reactance matrices obtained by Msezane and Henry in a program developed by Brandt, Truhlar, and Smith to calculate angular differential cross sections. Agreement in shape between theory and experiment at 75 eV is excellent. Experiments were carried out in a crossed electron-ion-beam geometry for the $4s \rightarrow 4p$ transition in Zn^+ at 75 eV, and they are the first measurements for differential electron-scattering cross sections for inelastic excitation of an ion.

56559 **(INIS-mf—4754(No.20)) International bulletin on atomic and molecular data for fusion. No. 20.** Katsonis, K. (ed.). (International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit). 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703477.

This bulletin deals with atomic and molecular data for fusion. A bibliography for the most recent data presented in the document is provided. The bulletin contains a list of references covering the year 1982 for all the publications on controlled thermonuclear fusion and plasma physics.

56560 **(INIS-mf—4754(No.21)) International bulletin on atomic and molecular data for fusion. No. 21.** Katsonis, K. (ed.). (International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit). 1983. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703478.

This bulletin deals with atomic and molecular data for fusion. A bibliography for the most recent data presented in the document is provided. Work in progress is also briefly reported (Electron Loss and Capture Cross Sections for C atoms in He, Calculations of Electron Impact Ionization Cross Sections). The document contains a list of references covering the years 1980, 1981 and 1982 for publications on fusion and plasma physics.

56561 **(KFK—3455) High resolution measurements of isotope shifts and hyperfine structure in stable and radioactive lead isotopes.** Thompson, R.C.; Anselment, M.; Bekk, K.; Goering, S.; Hanser, A.; Meisel, G.; Rebel, H.; Schatz, G.; Brown, B.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik). Dec 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751026.

We present new measurements of isotopic shifts and hyperfine structure in the lead resonance line for a total of 15 isotopes. The experimental accuracy is of order 4 MHz. Using independent measurements of the nuclear parameter lambda for the stable isotopes we have derived lambda for all measured isotopes. The derived lambda values are compared with various theoretical predictions for the lead nuclei. We also give values for the nuclear magnetic dipole and electric quadrupole moments deduced from our measurements.

56562 **Infrared photodissociation of hydrogen-bonded clusters: C_2H_4xHF and C_2H_4xHCl.** Casassa, M.P.; Western, C.M.; Celii, F.G.; Brinza, D.E.; Janda, K.C. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). *Journal of Chemical Physics;* **79**: No. 7, 3227-3233(1 Oct 1983).

Infrared photodissociation spectra of C_2H_4xHF, C_2H_4xHCl, and C_2H_4xNO formed in molecular beams are reported. Parameters determined are absorption frequencies ω_0, initial-state lifetimes tau, and transition moments $<\mu>^2$. While the frequency for C_2H_4xHF is close to that observed in an Ar matrix, the frequency for C_2H_4xHCl is shifted 6.8 cm^{-1} further than that observed in a matrix. The results are discussed in terms of the bonding interaction and the photodissociation mechanism.

56563 Two photon resonant, four photon ionization of CO via the A ^{1}Pi state with photoelectron energy analysis. Pratt, S.T.; Dehmer, P.M.; Dehmer, J.L. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* 79: No. 7, 3234-3239(1 Oct 1983). Contract W-31-109-ENG-38.

We report measurements of photoelectron spectra from resonantly enhanced four photon ionization of CO via a two photon transition to the R-branch heads of the A ^{1}Pi, v = 1—3 ← X $^1\Sigma^+$, v = 0 bands. In addition, we present preliminary data on the rotational state dependence of the photoelectron spectra. The results are compared with our earlier measurements of the photoelectron spectra obtained in the six photon ionization of CO via a three photon resonant transition to the same intermediate levels. The observed vibrational branching ratios in the photoelectron spectra differ both from those observed in the earlier study and from the pattern predicted by the Franck—Condon overlap between the intermediate A ^{1}Pi state and the ionization continua. It is shown that accidental resonances with the J $^1\Sigma^+$ state at the three photon energy account for the observed photoelectron spectra obtained at the wavelengths of the A ^{1}Pi, v = 2,3 R-branch bandheads. Finally, we present conclusive evidence for the production of electronically excited CO^+ A ^{2}Pi and discuss possible mechanisms for its formation.

56564 Vibrational energy exchange between carbon dioxide and hydrogen sulfide. Hoke, J.; Preses, J.M.; Weston, R.E. Jr. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* 79: No. 7, 3596-3597(1 Oct 1983).

A mixture of CO_2 and H_2S was irradiated with a low-pressure Q-switched CO_2 laser, and the infrared emission from $CO_2(00^01)$ was observed. The rates of collisional energy transfer to H_2S were computed from the observed infrared fluorescence. (AIP)

56565 Radiationless transitions in a new light. Heller, E.J.; Brown, R.C. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* 79: No. 7, 3336-3351(1 Oct 1983).

Radiationless transitions in polyatomic molecules prove to be quite amendable to a semiclassical treatment both below and above crossings between the potential surfaces involved in the transition. Below such crossings, tunneling integrals are easily performed which give good estimates of the dependence of the nonradiative rate on the energy gap and excess energy in the electronic state. Above the surface crossing, the transitions become classically allowed and a Tully—Preston surface hopping model suffices. We find that a nonlinear dependence of ln(k/sub n//sub r/) vs E plots is the rule rather than the exception. The ln(k/sub n//sub r/) vs E plots tend to flatten out with increasing energy. This effect can occur below surface crossings, but is most dramatic when a surface crossing is reached. The recent beam results of Smalley and coworkers on pyrazine and pyrimidine are seen to be a possible case of this simple behavior.

56566 Comment on "A time-dependent quantum mechanical theory for multiphoton dissociation of diatomic molecules". Whaley, K.B.; Light, J.C. (The James Franck Institute and the Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). *Journal of Chemical Physics;* 79: No. 7, 3604-3605(1 Oct 1983).

The rate of dissociation of a diatomic molecule in the presence of an intense infra-red laser field is derived, using a non-perturbative method. The T-matrix elements for absorption from an initial bound state to a dissociative state were calculated. (AIP)

56567 Method to determine the number of constants of the motion for multidimensional systems. Stine, J.R. (Los Alamos National Lab., NM); Noid, D.W. *Journal of Physical Chemistry;* 87: No. 16, 3038-3042(4 Aug 1983). Contract W-7405-ENG-36;W-7405-ENG-26.

A simple numerical method is presented to determine the number of constants of the motion (integrals) for multidimensional nonseparable Hamiltonians with n degrees of freedom. This method is based on the fact that a trajectory with k constants of the motion will be confined to a 2n-k dimensional surface of phase space. The method is applied to model systems of two and three degrees of freedom. 5 figures, 2 tables.

56568 Isoelectronic wavelength predictions for magnetic-dipole, electric-quadrupole, and intercombination transitions in the Mg sequence. Curtis, L.J.; Ramanujam, P.S. (Department of Physics and Astronomy, University of Toledo, Toledo, Ohio 43606). *Journal of the Optical Society of America;* 73: No. 8, 979-984(Aug 1983). Contract AS05-80ER10676.

Precise wavelength predictions are presented for the $3s3p\ ^3P_1$-$3s3p\ ^3P_2$ magnetic-dipole transitions, the $3s3p\ ^3P_0$-$3s3p\ ^3P_2$ electric-quadrupole transitions, and the $3s^2\ ^1S_0$-$3s3p\ ^3P_1$ intercombination lines for all members of the Mg isoelectronic sequence with Z< or =45. Magnetic-dipole and intercombination transitions of this type have recently been observed in tokamak spectra and have applications for localized diagnostics in high-temperature plasmas. The predictions are based on interpolations and extrapolations of empirical regularities, which also provide insights into the dynamics of these atomic systems.

56569 Algebraic descriptions of nuclear and molecular rotation-vibration spectra. Mean field techniques and interacting boson models. van Roosmalen, O.S. Groningen, Netherlands; Rijksuniversiteit (1982). 142p. Available from University Library, Oude Kijk in 't Jatstraat 5, 9712 EA Groningen (Netherlands).

Thesis.

The application of algebraic models to the description of rotational and vibrational degrees of freedom of nuclei and molecules are discussed. Simple model Hamiltonians are shown to give good agreement with the energy spectra of diatomic molecules and nuclei. Some formal aspects of path integral methods for many-boson systems are treated. The two representations for the quantum mechanical propagator are compared and appear to be identical in leading order in 1/N (N is the number of bosons). Approximations for both static and dynamic problems are discussed. Applications of mean field techniques are also treated. A description of tri- and tetra-atomic molecules in terms of a U(4)xU(4) and U(4)xU(4)xU(4) group structure is given. Linear molecules appear to correspond with symmetries of O(4) type. S-matrix elements are calculated to test mean field methods, and the results compared with exact calculations.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 56300, 56679

56570 (ANL—83-73) Fully-coupled solution of pressure-linked fluid flow equations. Vanka, S.P.; Leaf, G.K. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 36p. NTIS, PC A03/MF A01. Order Number DE83017989.

A robust and efficient numerical scheme has been developed for the solution of the finite-differenced pressure linked fluid flow equations. The algorithm solves the set of nonlinear simultaneous equations by a combination of Newton's method and efficient sparse matrix techniques. In tests on typical recirculating flows the method is rapidly convergent. The method does not require any under-relaxation or other convergence-enhancing techniques employed in iterative schemes. It is currently described for two-dimensional steady state flows but is extendible to three dimensions and mildly time-varying flows. The method is robust to changes in Reynolds number, grid aspect ratio, and mesh size. This paper reports the algorithm and the results of calculations performed.

56571 (CONF-8308125—1) Quantum-mechanical calculations of the properties of liquid He droplets. Pieper, S.C. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE84000164.

From 3. international conference on recent progress in many-body theories; Altenberg, F.R. Germany (29 Aug 1983).

We have made calculations of the ground-state properties of droplets of liquid ^{4}He, and are presently involved in calculations

for droplets of liquid ^{3}He. The already published ^{4}He results are summarized; the ^{3}He results presented are preliminary.

56572 **(DOE/ET/53045—T2) Viscous, resistive MHD stability computed by spectral techniques.** Dahlburg, R.B.; Zang, T.A.; Montgomery, D.; Hussaini, M.Y. (College of William and Mary, Williamsburg, VA (USA); National Aeronautics and Space Administration, Hampton, VA (USA). Inst. for Computer Applications in Science and Engineering). Mar 1983. Contract AS05-76ET53045. 30p. NTIS, PC A03/MF A01. Order Number DE83016234.

Expansions in Chebyshev polynomials are used to study the linear stability of one-dimensional magnetohydrodynamic (MHD) quasi-equilibria in the presence of finite resistivity and viscosity. The method is modeled on the one used by Orszag in accurate computation of solutions of the Orr-Sommerfeld equation. Two Reynolds-like numbers involving Alfven speeds, length scales, kinematic viscosity, and magnetic diffusivity govern the stability boundaries, which are determined by the geometric mean of the two Reynolds-like numbers. Marginal stability curves, growth rates versus Reynolds-like numbers, and growth rates versus parallel wave numbers are exhibited. A numerical result which appears general in that instability has been found to be associated with inflection points in the current profile, though no general analytical proof has emerged. It is possible that nonlinear subcritical three-dimensional instabilities may exist, similar to those in Poiseuille and Couette flow.

56573 **(INIS-mf—8529) Disappearance of superfluidity in helium films.** Bannink, G. (Rijksuniversiteit Leiden (Netherlands)). 1983. 125p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703481.

Thesis.

Experiments to investigate the changes in superfluid properties when helium films become thinner are reported. A thin-film oscillator, formed by two large film reservoirs connected by a long and narrow tube, is used to study both the mass transport properties and the third-sound phenomena. Both sets of data are analysed in the framework of a two-fluid model. Absolute values for the areal superfluid density are deduced from the results, and also the observation of friction in the film itself is briefly discussed. A series of additional measurements of the thermo-mechanical effect in the reservoirs, with the purpose of determing the thickness at which onset of superfluidity occurs, are also reported. Finally the overall picture of the film properties is discussed on the basis of a phase diagram of the observed mobilities.

56574 **(N—8323546) Long-time states of inverse cascades in the presence of a maximum length scale.** Hossain, M.; Matthaeus, W.H.; Montgomery, D. (College of William and Mary, Williamsburg, VA (USA)). 1983. 32p. (NASA-CR—170268). NTIS, PC A03/MF A01.

It is shown numerically, both for the two-dimensional Navier-Stokes (guiding-center plasma) equations and for two-dimensional magnetohydrodynamics, that the long-time asymptotic state in a forced inverse-cascade situation is one in which the spectrum is completely dominated by its own fundamental. The growth continues until the fundamental is dissipatively limited by its own dissipation rate.

56575 **Vortices, stability, and turbulence.** Saffman, P.G. (California Inst. of Technology, Pasadena). *Annals of the New York Academy of Sciences;* **404**: 12-24(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

The existence and properties of coherent or organized structures in turbulent flow are subjects of considerable interest. The hypothesis that these are related to the existence of finite amplitude vortical states is discussed. Several examples of such states are described and their properties and susceptibility to three-dimensional instabilities are considered. It is remarked that features of transition phenomena and turbulence can be explained qualitatively in terms of the vortical state charactertistics.

56576 **Multiscale expansions in nonlinear stability theory.** Pismen, L.M. (City Univ. of New York, NY). *Annals of the New York Academy of Sciences;* **404**: 135-149(1983). (DOE/ER/12020—1; CONF-8206187—).

From 4. physico-chemical hydrodynamics conference; New York, NY, USA (13 Jun 1982).

Multiscale expansion is a method appearing under different disguises in a variety of physical problems. The main components of the method can be defined as a local structure and an order parameter. The local structure, which is governed by underlying short-range equations, reproduces itself throughout an extended system while being smoothly modulated by one or more order parameters slowly varying on a long scale. The application of this method consists of the derivation of evolution equations governing the long-range behavior of order parameters. These equations are always incomparably simpler than the full set of underlying equations. This simplicity and universality is a major asset of the method, both practically and aesthetically. But most useful theoretical lessons are learned, perhaps, from those situations where the method breaks down and smooth long-range variation gives way to shock structures. This survey starts with an outline of the derivation of long-range equations. The classical problem of Taylor diffusion serves as an introductory example. It is followed by an analysis of generalized phase dynamics, which is the source of two basic long-range equations: the Burgers equation in a dissipative case and the Kuramoto-Sivashinsky equation in a weakly antidissipative case. We shall discuss the dynamics of shocks in these equations, which give, perhaps, the clearest demonstration of the phenomenon of intermittency. After reaching this double peak of universality we shall descend to other examples, supplied mostly by shallow-water theory, where the variety of long-range equations is multiplied by non-Newtonian effects and the presence of multiple order parameters. In these cases, the development of shocks is most prominent and long-range theory can be often retained only in the proximity of a bifurcation point.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 56129, 56642

56577 **(INIS-mf—8503) Annual Report January 1981 - June 1982.** (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 1982. 116p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703530.

This is the first English language report describing the activities of Section K of the National Institute of Nuclear Physics and High Energy Physics, NIKHEF, which is the new name of what up to January 1, 1981 was called the Institute of Nuclear Physics Research, IKO. It covers the period January 1981 - June 1982. Brief reports are submitted from the various project groups which are grouped under the following subject headings: electron scattering (29 reports); physics with pions, muons and baryons (15 reports); theory (12 reports); radio and nuclear chemistry (28 reports); and MEA technical departments (4 reports). Publications by the staff and contributions to conferences are also listed. (C.F.).

56578 **(INIS-mf—8526) NIKHEF Annual Report 1981.** (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 1982. 239p. (In Dutch). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83703532.

This annual report presents the activities of the Dutch National Institute for Nuclear and High Energy Physics (NIKHEF) during its first year. Following a general introduction to the research areas in which NIKHEF is involved, 29 brief reports from the project groups are presented. Details concerning personnel, participation in councils and committees, finances, publications, colloquia and participation in congresses and schools are included.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 56676

56579 (ANL-HEP-CP—83-41) Properties of D* production in e^+e^- annihilation at 29 GeV. Ahlen, S.; Akerlof, C.; Baranko, G.; Baringer, P.; Beltrami, I.; Bender, D.; Blockus, D.; Brabson, B.; Chapman, J.; Cork, B. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Lawrence Berkeley Lab., CA (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA); Stanford Linear Accelerator Center, CA (USA)). 1983. Contract W-31-109-ENG-38. 14p. (CONF-8308101—4). NTIS, PC A02/MF A01. Order Number DE84000573.

From International symposium on lepton and photon interactions at high energies; Ithaca, NY, USA (4 Sep 1983).

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D^* production is studied in the decay chain $D^{*+} \rightarrow D^0 \pi^+$ with the D^0 observed in the $K^-\pi^+$ mode and the corresponding charge conjugate decays. The results were obtained from a preliminary analysis of an 80 pb^{-1} data sample of e^+e^- annihilations at 29 GeV taken with the High Resolution Spectrometer at PEP. The excellent mass resolution of the HRS allows the study of the D^* production and decay with very low background. We present the fragmentation function over the range of Z from 0.2 to 1.0.

56580 (ANL-HEP-CP—83-54) Study of quark fragmentation at 29 GeV. Ahlen, S.; Akerlof, C.; Baranko, G.; Beltrami, I.; Bender, D.; Baringer, P.; Blockus, D.; Brabson, B.; Chapman, J.; Cork, B. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Lawrence Berkeley Lab., CA (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA); Stanford Linear Accelerator Center, CA (USA)). 1983. Contract W-31-109-ENG-38. 14p. (CONF-830689—4). NTIS, PC A02/MF A01. Order Number DE84000590.

From 14. international symposium on multiparticle dynamics; Lake Tahoe, NV, USA (22 Jun 1983).

The study of multi-particle final state in high-energy reactions has a long history. Detailed studies of hadronic interactions at Fermilab and at the CERN ISR have shown that particles are emitted in clear jets of hadrons along the beam directions. For the highest energies, a small fraction of events contains large-angle jets originating from hard collisions, in addition to the beam and target fragmentation products. The clearest observation of jets has been in high-energy e^+e^- reactions. Hadronic interactions contain 5 or 6 valence quarks already in the initial state. The final state in e^+e^- annihilation represents at the parton level a relatively simple dynamical system: a q anti q state plus possibly a hard gluon therefore jets produced in e^+e^- annihilation have to be considered as the cleanest ones. The study of their properties can help, not only to understand quark fragmentation but may also serve as an important tool in the analysis of the much more complex mechanism in hadronic interactions. In this paper we present preliminary results of the overall features of our first sample of e^+e^- annihilation events at 29 GeV. The data were taken using the High Resolution Spectrometer (HRS) operated at the PEP storage ring at the Stanford Linear Accelerator Center.

56581 (BNL—33650) Hadronic production of glueballs. Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). 1983. Contract AC02-76CH00016. 9p. (CONF-830718—7). NTIS, PC A02/MF A01. Order Number DE83018279.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

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Local Gauge Invariance of SU(3)/sub c/ and color confinement would require that the only hadrons in the world be glueballs. However, when we add the quarks and obtain QCD it is experimentally clear that quark built states mask the expected glueballs. Thus discovery of glueballs is essential for the viability of QCD. Papers presented at the 1983 International Europhysics Conference on High Energy Physics on the hadronic production of glueballs and searches for glueballs are reviewed. (WHK)

56582 (BNL—33678) Update to the CBA SUSY studies. Littenberg, L.S.; Paige, F.E.; Weygand, D.P. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 21p. NTIS, PC A02/MF A01. Order Number DE84000625.

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This is an interim report on the study of the detection of supersymmetric particles at CBA. A previous report by Aronson et al. summarizes results as of July 1982, and the review article by Hinchliffe and Littenberg contains some addtional material. This report will consist of five sections: (I) update of $p + p \rightarrow g + g + X$ at moderate luminosity; (II) the effect of high luminosity on $p + p \rightarrow g + g + X$; (III) $p + p \rightarrow \gamma + q + X$; (IV) $W \rightarrow \gamma + W$; and (V) future studies.

56583 (DESY—83-007) QCD and hadron jets - new results from PEP and PETRA. Sau Lan Wu. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1983. 39p. (CONF-820897—5). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751032.

From Conference on physics at very high energy (SLAC Summmer School); Stanford, CA, USA (15 Aug 1982).

Recent experimental data related to hadron jets and QCD are reviewed from the ten detectors at PEP and PETRA. The many interesting new results include the measurements of the quark-gluon coupling constant αsub(s), the total hadronic cross section, and the gluon spin with high statistics, a possible difference between the quark and gluon jets, particle identification in jets, and a search for charged Higgs and technipions from four-jet events.

56584 (DESY—83-011) Recent results in two photon physics from JADE. Nozaki, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1983. 10p. (CONF-821196—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751029.

From Gamma-gamma seminar; Montpellier, France (1 Nov 1982).

Talk given at Gamma-Gamma Seminar at the University of Science and Technique of Languedoc, Montpellier, (France), Nov 1982.

Two topics in two photon physics from JADE are reported: The measurement of the photon structure function F_2 and the analysis of single A_3 and f production in two photon reactions. The photon structure function F_2 was measured at an average Q^2 of 23 GeV^2 and compared with the predictions of leading and higher order QCD as well as of the quark parton model. The QCD scale parameter Λ was determined by these comparisons. The analysis of the processes $e^+e^- \rightarrow e^+e^- A_3$ ($A_3 \rightarrow$ rhosup(+-)πsup(-+), rhosup(+-)->πsup(+-)π^0) and $e^+e^- \rightarrow e^+e^-$ f (f->$\pi^0\pi^0$) is presented. Preliminary values of GAMMAsub(A2γγ) and GAMMAsub(fγγ) are given.

56585 (DOE/ER/04660—T2) Very high energy nuclear physics. Progress report. Frankel, S. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Jun 1983. Contract AC02-78ER04660. 7p. NTIS, PC A02/MF A01. Order Number DE83014923.

In 1980 we carried out an extensive series of experiments on alpha-alpha collisions in the ISR. We were asked by the Axial Field Spectrometer Collaboration to lead this nuclear effort. We have since joined this collaboration on a permanent basis at their invitation. The purpose of the experiment was to discover something new, for example, to search for some evidence of new correlated behaviour, and, in particular, to search for the existence of the formation of a quark-gluon plasma. The reason for this hope lay in the fact that, as contrasted with the energies of 1 to 2 GeV/c per nucleon available at Kerkeley/Dubna, the ISR experiments were to be carried out at ultrarelativistic energies of 1000 GeV/c in the alpha cm. This is a region where it is known that the mean pion multiplicities are very large and it is possible to sample events with event multiplicities of at least 200. Another important feature was the fact that remarkable spectrometers existed at the ISR to make definitive studies of the whole event structure. The AFS spectrometer was designed specially to measure high transverse momentum p-p collisions (high pt) near 90 deg in the cm. Since it was capable of measuring the whole event structure it appeared to be a valuable

tool to study the anomalous high p/sub T/ p-nucleus cross sections, discovered at FERMILAB in 1975, and to extend these measurements for the first time to nucleus-nucleus studies. To describe the results of these experiments we list below the titles of papers published, in press, or in preparation which will have been completed by the end of this fiscal year, commenting on the results and their significance.

56586 (INIS-mf—8474, pp 25-28) **Short summary on lifetimes of D^0 and D^+.** Kitagaki, T. (Tohoku Univ., Sendai (Japan)). 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

56587 (INIS-mf—8474, pp 69-79) **Measurement of the νsub({) charged current cross section.** 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The Fermilab 15-ft bubble chamber, filled with a heavy neon-hydrogen mix, was exposed to a narrow band νsub(μ) beam. Based on the observation of 830 charged current νsub(μ) interactions, the cross section was found to rise linearly with the neutrino energy in the interval, 10 GeV<=Esub(ν)< or approximately 240 GeV, with a constant slope of: σΞsub(ν)/Esub(ν)=(0.64+-0.05)x10^{-38}cm^{2}GeV^{-1}. This result is discussed in relation to other experiments.

56588 (INIS-mf—8474, pp 81-85) **Anti-neutrino-nucleon charged current interaction cross sections measured by the Fermilab 15' Ne-H_2 bubble chamber in a dichromatic beam.** 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

Fermilab experiment E388 measurements of antineutrino-nucleon total charged-current interaction cross sections are reported for 20<Esub(antiν)<200 GeV. E388 used the Fermilab 15' Neon (56.5% atomic)-hydrogen bubble chamber (plus external muon identifier), exposed to the N30 dichromatic beam. E388 ran downstream of the CCFRR experiment E616 in this beam and used the same flux monitoring information. No evidence is seen for any variation of sigmasub(antiν)Esub(antiν) in this Esub(antiν) range. The preliminary average is in good agreement with most other measurements, but 20% below the E616 result pre-sented at this conference.

56589 (INIS-mf—8474, pp 109-138) **Charm production by neutrinos as seen in hadronic final states.** Baltay, C. (Columbia Univ., New York (USA)). 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The experiments for detecting charm production by neutrinos as seen in hadronic final states in bubble chambers are reviewed. Three methods of detection (exclusive events; inclusive charm production, detected as bumps in effective mass distribution; and charm decay with visible traces in bubble chamber) are described. Experimental data of masses of charmed baryons and mesons, of their mass differences, of branching ratios and of charm production rates are summarized and evaluated.

56590 (INIS-mf—8474, pp 139-142) **Antineutrino quasielastic scattering in neon and total cross section for charged current interactions in the energy range 10 to 50 GeV.** 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The quasi-elastic scattering of muon-antineutrinos on proton was investigated by the Fermilab bubble chamber filled with neon-hydrogen mixture. The total weak charged current cross section was measured and analysed. The axial mass parameter in the dipole representation of the axial form factor and the slope parameter of the total cross section-energy plot were determined.

56591 (INIS-mf—8474, pp 143-152) **Azimuthal asymmetries and muon inner bremsstrahlung in deep inelastic neutrino interactions.** 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

Progress is reported in understanding azimuthal asymmetries in the outgoing particles produced in neutrino interactions. The observed up-down asymmetry for all charged particles is significantly below some theoretical predictions. Muon inner bremsstrahlung (IB), a radioactive correction process, is identified as a spurious source of toward-away asymmetry. The total rate of IB and its dependence on the muon momentum, the angle between the muon and the IB gamma, and the gamma energy are in agreement with a QED calculation.

56592 (INIS-mf—8474, pp 153-176) **Recent results from the e^-e^+ storage rings PEP and PETRA.** Soeding, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

Recent results of high energy electron-positron colliders PEP and PETRA are summarized. The momentum transfer reached at colliders is Q^2=1300 GeV^2 and will be further increased. The recent improvement of luminosity allows search for rare events, e.g. for postulated particles. Experimental results on electroweak interaction of leptons and quarks, on weak particle decays, on hadronic jet and three-jet events are described. Limits on pair production of possible scalar particles (Higgs particles or technipions) are given.

56593 **(KFK—3441) Search for bound baryonium states and rare annihilation channels via γ-spectrometry.** Richter, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kern- und Teilchenphysik). Feb 1983. 105p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83751004.

The measurement of the inclusive γ-spectra of the reaction anti psub(stop)p offers the possibility of detecting transitions of the type anti pp-> Baryonium + γ. An experiment at the CERN-Protonsynchrotron was performed stopping antiprotons in a liquid H_2-target. The inclusive γ-spectra were measured with a high resolution modular NAI(TL)-detector and a large NAI(TL)-measured monocrystal. In addition γγ-coincidences at 180° were registered. The experiment was performed in two major running periods (1979 and 1980).

56594 **(KFK—3474) Search for new particles in e^+-e^- annihilation.** Fluegge, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kern- und Teilchenphysik). Sep 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751003.

Talk at the DESY workshop 1982 on electroweak interactions at high energies, 28-30 Sep 1982.

Extensive searches for new particles have been performed at e^+e^- storage rings. No new leptons or quark flavours have been found up to centre of mass energies of 36.75 GeV. Also the search for new scalars has been negative. In particular, supersymmetric leptons must have masses larger than 16 GeV and charged technipions and "standard" axions can be excluded.

56595 **(LA—9847-MS) Hyperon source using LAMPF II.** Oostens, J. (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01. Order Number DE84000127.

Hyperon physics for LAMPF II is surveyed. The present status of the hyperon-nucleon interaction is reviewed. Methods of producing tagged and polarized hyperons are discussed. A final section deals with the development of high-resolution detectors for these experiments. 29 references.

56596 (MPI-PAE/Exp.El.—113) Multiplicities of secondary hadrons produced in νp and anti νp charged current interactions. Graessler, H.; Lanske, D.; Schulte, R.; Jones, G.T.; Middleton, R.P.; O'Neale, S.W.; Boeckmann, K.; Gebel, W.; Geich-Gimbel, C.; Nellen, B. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). 1983. 45p. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen, Germany, F.R.

Aachen-Birmingham-Bonn-CERN-Imperial College-Muenchen(MPI)-Oxford Collaboration.

In an experiment with the hydrogen bubble chamber BEBC at CERN multiplicities of hadrons produced in νp and anti ν interactions have been investigated. Results are presented on the multiplicities of charged hadrons and neutral pions, forward and backward multiplicities of charged hadrons and correlations between forward and backward multiplicities. Comparisons are made with hadronic reactions and e^+e^- annihilation. In the framework of the quark-parton model the data imply similar charged multiplicities for the fragments of a u- and a d-quark, and larger multiplicities for the fragments of a uu- than for a ud-diquark. The correlation data suggest independent fragmentation of the quark and diquark for hadronic masses above approx.=7 GeV and local charge compensation within an event.

56597 Inclusive inelastic reaction np→pX at 795 MeV. Glass, G.; Jain, M.; Northcliffe, L.C.; Hollas, C.L.; Newsom, C.R.; Riley, P.J.; Bonner, B.E.; Simmons, J.E. (Texas A&M University, College Station, Texas 77843). *Physical Review [Section] D: Particles and Fields;* **28**: No. 5, 1045-1049(1 Sep 1983).

The inclusive reaction np→pX, where X includes a pion, has been studied at 795 MeV with measurements of the cross section $d^3\sigma/dp\ d\Omega$. Proton momentum spectra were measured for laboratory angles between 0° and 31°. These angles cover the full forward hemisphere in the center-of-mass system and give, with the use of symmetry assumptions, a value for the total reaction cross section, σ/sup R/ = 11.0 +- 0.8 mb, exclusive of the np→dπ° reaction. The data are also presented as measurements of the cross section $d^3\sigma/dt\ dM$, where t is the four-momentum transfer squared and M is the invariant missing mass. The results are compared with a model calculation of one-pion exchange that includes rho and ω exchange. The t dependence is also discussed in terms of a statistical model.

56598 Experimental test of higher-order QED and a search for excited muon states. Ford, W.T.; Read, A.L. Jr.; Smith, J.G.; Marini, A.; Peruzi, I.; Piccolo, M.; Ronga, F.; Baksay, L.A.; Band, H.R.; Faissler, W.L. (Department of Physics, University of Colorado, Boulder, Colorado 80309). *Physical Review Letters;* **51**: No. 4, 257-260(25 Jul 1983).

The reactions $e^+e^-\rightarrow\mu^+\mu^-\gamma\gamma$ and $e^+e^-\rightarrow\mu^+\mu^-\gamma$ have been studied at $\sqrt{s}$ = 29 GeV with the MAC detector at the SLAC storage ring. The measured cross sections, charge asymmetry, and invariant-mass distributions are in good agreement with the predictions of QED theory. Limits are derived for the production of excited muon states.

56599 Experimental limits on magnetic monopole catalysis of nucleon decay. Errede, S.; Stone, J.L.; van der Velde, J.C.; Bionta, R.M; Blewitt, G.; Bratton, C.B.; Cortez, B.G.; Foster, G.W.; Gejewski, W.; Goldhaber, M. (The University of California at Irvine, Irvine, California 92717; The University of Michigan, Ann Arbor, Michigan 48109; Brookhaven National Laboratory, Upton, New York 11973; California Institute of Technology, Pasadena, California 91125; Cleveland State University, Cleveland, Ohio 44115). *Physical Review Letters;* **51**: No. 4, 245-248(25 Jul 1983).

A search for superheavy magnetic monopoles "catalyzing" nucleon decay via the reaction M+N→M+e^++mesons in an underground water Cherenkov detector has been carried out. No positive evidence for such a process has been found during 100 d of detector live time. Within the cross section and velocity ranges σ/sub c/> or =0.1 mb and 10^{-6}< or =β/sub m/< or =10^{-1} σ/sub c/- and β/sub m/-dependent limits on the monopole flux are presented which go as low as F/sub m/<7.2 x 10^{-15} cm^{-2} sr^{-1} s^{-1} (90% C.L.). For very low cross sections, velocity-independent limits on the monopole flux and interaction rate are obtained.

56600 New measurement of the rate for pion beta decay. McFarlane, W.K.; Auerbach, L.B.; Gaille, F.C.; Highland, V.L.; Jastrzembski, E.; Macek, R.J.; Cverna, F.H.; Hoffman, C.M.; Hogan, G.E.; Morgado, R.E. (Physics Department, Temple University, Philadelphia, Pennsylvania 19122). *Physical Review Letters;* **51**: No. 4, 249-252(25 Jul 1983).

The conserved-vector-current hypothesis, together with measured nuclear-beta-decay rates, predicts a value of the rate for the decay $\pi^+\rightarrow\nu\pi^0e^+\nu$ of 0.4027 +- 0.0018 s^{-1}. With use of a decay-in-flight technique the authors have made the most precise measurement to date of this rate, obtaining the value 0.398 +- 0.015 s^{-1}, in good agreement with the prediction.

56601 πip scattering at 65 to 140 MeV. Ritchie, B.G.; Moore, R.S.; Preedom, B.M. (South Carolina Univ., Columbia (USA)); Das, G.; Minehart, R.C. (Virginia Univ., Charlottesville (USA)); Gotow, K. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)); Burger, W.J. (Massachusetts Inst. of Tech., Cambridge (USA)); Ziock, H.J. (Los Alamos National Lab., NM (USA)). *Physics Letters, [Section] B;* **125**: No. 2/3, 128-132(26 May 1983).

Differential cross sections for π^+p elastic scattering were measured for seven incident energies from 65 to 140 MeV at laboratory scattering angles between 93° and 165°. The results are compared with previous results of Bertin et al. and the phase-shift analysis of Arndt and Roper. Agreement between the phase-shift analysis and the data is good.

56602 Heavy ion pion production: Spectral irregularities. Rasmussen, J.O. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics [Section] A;* **400**: 383c-397c(23 May 1983). (CONF-820979—). Contract AC03-76SF00098.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

Also published as report LBL--14956, Sep 1982.

Data on π^-/π^+ ratios and on hills and valleys in spectra from heavy ion collisions are reviewed. Theoretical studies to handle Coulomb effects on pion spectra are examined. The possible role of strongly-bound pion orbitals of nuclear size is discussed.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 56602, 56635, 56645, 56676

56603 (CONF-830675—6) Multiquark exotics. Lipkin, H.J. (Argonne National Lab., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA); Weizmann Inst. of Science, Rehovoth (Israel)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE83017958.

From 6. high energy heavy ion study and 2. workshop on anomalons; Berkeley, CA, USA (28 Jun 1983).

The question Are Anomalons Multiquark Exotics is discussed. It is concluded that so far there is no convincing experimental evidence for any multiquark exotic bound state nor for any exotic resonance. Except for the δ and S* there are no candidates for bound states and no firm theoretical predictions waiting to be tested. Exotic resonances may exist in the 1.5 to 2.0 GeV region and in the charmed sector, e.g., the charmed-strange exotics. The experimental search for multiquark resonances is still open and active. (WHK)

56604 (DESY—83-008) QCD self-energy contribution to mass-shifts in the ^{3}Psub(J)-states. Krammer, M.; Schneider, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1983. 3p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751031.

We calculate the self-energy contribution to the mass shift of the ^{3}Psub(J)-states via the two gluon intermediate state. The effect

consists of an overall shift for all states, which depends on the potential energy, and individual displacements. The corrections are typically of the order of a few MeV.

56605 **(DOE/ER/03992—532) Research program in elementary-particle theory, 1983. Progress report.** Sudarshan, E.C.G.; Ne'eman, Y. (Texas Univ., Austin (USA). Center for Particle Theory). Aug 1983. Contract AS05-76ER03992. 81p. NTIS, PC A05/MF A01. Order Number DE84000462.

Portions are illegible in microfiche products.

Progress is reviewed on the following topics: physics of ultra high energies and cosmology; phenomenology of particle physics; quantum field theory, supersymmetry and models of particles; and geometric formulations and algebraic models. Recent DOE reports resulting from the contract are listed. (WHK)

56606 **(DOE/ER/40085—4) Diquark model of the baryon spectrum.** Haire, M.L. (Tufts Univ., Medford, MA (USA)). May 1983. Contract AC02-83ER40085. 169p. NTIS MF A01. Order Number DE84000838.

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The presence of a coherent diquark structure within baryons has been suggested, both as a computational tool for simplifying some types of baryon calculations, and as an explanation for scaling violations in deep inelastic scattering. In this paper we consider the implications of the diquark hypothesis for baryons spectroscopy. Treating the diquark as an s-wave bound state of two quarks reduces the problem of three-body quark excitations within baryons to that of a two-body quark-diquark interaction. The spin-dependent excitation levels of the quark-diquark system can then be calculated in perturbative QCD, using a non-relativistic one-gluon-exchange approximation. The spectrum generated by this model differs from the conventional symmetric quark model spectrum in several crucial respects. Firstly, spin-orbit mass splitting between baryons is easily accommodated in the diquark picture, unlike the conventional model, where it must be cancelled ad hoc in order to obtain a reasonable fit to the mass spectrum. Secondly, the QCD parameters needed to fit the baryon spectrum in the diquark model are essentially the same as those used in the meson spectrum. This allows us to give a unified description of spin-dependent forces in mesons and baryons, which has not been possible in the symmetric quark model. We conclude with a qualitative discussion of spin-independent (multiple gluon exchange) forces in the diquark model, using effective confining potentials of the form, V(r) ~ r/sup n/. 28 references.

56607 (INIS-mf—8474, pp 87-107) **Contribution of twist-4 to the Q^2 evolution of F_2 and xF_3 - an experimental review.** Morfin, J.G. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1982. NTIS (US Sales Only), PC A09/MF A01. (CONF-820675—Vol.3).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The scale breaking properties of the nucleon structure functions are discussed. Particle kinematical sources of scale breaking like the effect of target mass and dynamical sources are investigated on the basis of perturbative quantum chromodynamics. Twist-4 and higher twist contributions are calculated and compared with recent experimental data. Proposed new experimental circumstances which would be appropriate detecting higher twist effects are summarized.

56608 **(SLAC-PUB—3102) Theoretical perspectives on strange physics.** Ellis, J. (Stanford Linear Accelerator Center, CA (USA)). Apr 1983. Contract AC03-76SF00515. 17p. (CONF-830339—5). NTIS MF A01. Order Number DE83018085.

From Theoretical symposium on intense medium energy sources of strangeness; Santa Cruz, CA, USA (19 Mar 1983).

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Kaons are heavy enough to have an interesting range of decay modes available to them, and light enough to be produced in sufficient numbers to explore rare modes with satisfying statistics. Kaons and their decays have provided at least two major breakthroughs in our knowledge of fundamental physics. They have revealed to us CP violation, and their lack of flavor-changing neutral interactions warned us to expect charm. In addition, K^0-anti K^0 mixing has provided us with one of our most elegant and sensitive laboratories for testing quantum mechanics. There is every reason to expect that future generations of kaon experiments with intense sources would add further to our knowledge of fundamental physics. This talk attempts to set future kaon experiments in a general theoretical context, and indicate how they may bear upon fundamental theoretical issues. A survey of different experiments which would be done with an Intense Medium Energy Source of Strangeness, including rare K decays, probes of the nature of CP isolation, μ decays, hyperon decays and neutrino physics is given. (WHK)

56609 **(SLAC-PUB—3124) Operation and maintenance linear accelerator. Conference summary.** Feldman, G.J. (European Organization for Nuclear Research, Geneva (Switzerland)). 1983. Contract AC03-76SF00515. 14p. (CONF-830374—3). NTIS, PC A02/MF A01. Order Number DE83018084.

From Moriond conference on electroweak interactions; Les Arcs, France (13 Mar 1983).

In the opening talk of this meeting, G. Kane defined the minimal standard model to be: (a) three generations of quarks and leptons; (b) massless neutrinos; (c) SU(3)/sub colour/ x SU(2)/sub L/ gauge theory; (d) one neutral Higgs boson; and (e) CP violation solely in the mass matrix. Reaching this point has been the tremendous achievement of the past decade. We have witnessed the discoveries of charm and the third generation, the discovery of neutral currents and the detailed confirmation of SU(2)/sub L/ x U(1), and the discovery of asymptotic freedom and the development of QCD and its experimental tests. In spite of these achievements, the resulting standard model is not entirely esthetically pleasing. It lacks a coherence which would explain its varied form and parameters; as a result, I would wager that none of us here believes that it represents the end of physics. A review of experimental activities is given. These fall into three general categories: searching for evidence of physics beyond the minimal standard model, testing the standard model, and making detailed measurements within this standard model. (WHK)

56610 **Self-dual gauge field, its quantum fluctuations, and interacting fermions.** Flory, C.A. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **28**: No. 6, 1425-1433(15 Sep 1983). Contract AC03-76SF00515.

The quantum fluctuations about a self-dual background field in SU(2) are computed. The background field consists of parallel and equal uniform chromomagnetic and chromoelectric fields. Determination of the gluon fluctuations about this field yields zero modes, which are naturally regularized by the introduction of massless fermions. This regularization makes the integrals over all fluctuations convergent, and allows a simple computation of the vacuum energy which is shown to be lower than the energy of the configuration of zero field strength. The regularization of the zero modes also facilitates the introduction of heavy test charges which can interact with the classical background field and also exchange virtual quanta. The formalism for introducing these heavy test charges could be a good starting point for investigating the relevant physics of the self-dual background field beyond the classical level.

56611 **Photino and gluino production from quarkonium decay.** Keung, W. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **28**: No. 5, 1129-1131(1 Sep 1983). Contract AC02-76CH00016.

The branching ratios of $\Gamma(V \to g\ g\ g)/\Gamma(V \to 3g)$ and $\Gamma(V \to g$ g gamma-tilde $)/\Gamma(V \to gg\ \gamma)$ could be larger than 10% for the scalar-quark mass less than 1.3 times the mass of the quark in the quarkonium V. The signature of these events would be the large momentum imbalance, especially for the case of the photino production.

56612 **Production of a single heavy quark in e^+e^- collisions.** Eilam, G. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **28**: No. 5, 1202-1205(1 Sep 1983).

Cross sections for the flavor-changing neutral transition $e^+e^-\rightarrow$t-barc are calculated in the standard model with three generations, and found to be unmeasurable; $e^+e^-\rightarrow$b-bars is a few orders of magnitude larger. Experimentalists should nevertheless look for these processes since an increase in the number of generations, strong-interaction effects, and mainly nonstandard models may lead to observable rates. Z^0 decays into a single heavy quark plus a light one are also briefly discussed.

56613 **One-dimensionality in glassy carbon.** Baker, D.F.; Bragg, R.H. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, and Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **28**: No. 4, 2219-2221(15 Aug 1983). Contract AC03-76SF00098.

A negative T/sup -1/2/ dependence of a component of the electrical conductivity, indicative of one-dimensional transport, was found in glassy carbon heat treated at temperatures less than 2200 °C. The micro- p structure, as examined in lattice images in the transmission electron microscope, the Porod-law dependence obtained in small-angle scattering, and the decrease in the d_{002}-spacing interlayer as measured by x-ray diffraction (above this critical temperature) support this thesis.

56614 **Hadron electromagnetic mass differences and a prediction of B^+-B^0.** Chan, L. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803). *Physical Review Letters;* **51**: No. 4, 253-256(25 Jul 1983).

It is proposed that the dynamical contribution to the hadron electromagnetic mass difference induced by the splitting of the up and down quark masses can be extracted phenomenologically from the quark masses by interpolation, in accordance with general QCD assumptions. The results are consistent with all observed electromagnetic mass differences. The model-independent prediction B^0-B^+ = 2.3 +- 0.3 MeV will serve as a crucial test for these assumptions. A useful mass formula for the s-wave hadron ground states is also presented.

56615 **Fractional charges: Global and local aspects.** Bardeen, W.A. (Fermi National Accelerator Lab., Batavia, IL (USA)); Elitzur, S. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Frishman, Y. (Weizmann Inst. of Science, Rehovoth (Israel)); Rabinovici, E. (European Organization for Nuclear Research, Geneva (Switzerland)). *Nuclear Physics [Section] B;* **218**: No. 2, 445-458(6 Jun 1983).

The properties of topological objects with fractional charge are studied. We first transform to new variables, in terms of which the lowest order contribution gives the fractional charge. We then gauge that fractional charge. Effects of the theta angle in two dimensions are studied. In particular arbitrary periods may be obtained. Induced extra charge due to theta turns out to be proportional to √theta. C and P violations due to theta may be arbitrarily small in some cases.

56616 **Analysis of (banti b)-states in a static one-parameter potential model.** Steiger, A. (Lawrence Livermore National Lab., CA (USA)). *Physics Letters, [Section] B;* **125**: No. 2/3, 223-226(26 May 1983).

Masses and leptonic widths of (banti b)-states are calculated with the potential V(r)=[8π/(33 - 2Nsub(F))](1 - lambdar)²/(r log lambdar). Particularly good agreement with recently published experimental results, including the average mass of the three observed P-wave states chisub(b)', is obtained for the constituent quark mass msub(b)=4.735 GeV, the QCD-parameter Λ = exp(-γsub(E))lambda = 362.2 MeV, and the number of active flavors Nsub(F)=4.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 56569, 56621

56617 **(BONN-HE—82-35) Supersymmetric quantum mechanics.** de Crombrugghe, M.; Rittenberg, V. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Dec 1982. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751006.

We give a general construction for supersymmetric Hamiltonians in quantum mechanics. We find that N-extended supersymmetry imposes very strong constraints, and for N > 4 the Hamiltonian is integrable. We give a variety of examples, for one-particle and for many-particle systems, in different numbers of dimensions.

56618 **New test for spontaneous breakdown of supersymmetry.** Bender, C.M.; Cooper, F.; Das, A. (Department of Physics, Washington University, St. Louis, Missouri 63130). *Physical Review [Section] D: Particles and Fields;* **28**: No. 6, 1473-1480(15 Sep 1983).

We propose a new nonperturbative test for supersymmetry breaking. The test is first to break supersymmetry by introducing a lattice and then to study the behavior of the ground-state energy as a function of the lattice spacing a. We assume that as a approaches zero, $E_0 \sim ca/sup\ \gamma/$, where c is a nonzero constant and γ is a critical exponent. If γ is positive as a→0, the ground-state energy of the continuum theory is zero and the theory is supersymmetric. On the other hand, if γ is zero or negative, then supersymmetry is broken. We verify this test in the context of supersymmetric quantum mechanics using a strong-coupling expansion to calculate E_0 and γ. We find that for the supersymmetric version of g^2x^6 quantum mechanics, γ = 1.16 +- 0.02, whereas γ is consistent with zero when we consider the supersymmetric extension of g^2x^4 theory.

56619 **Test of supersymmetry in e^-e^- collisions.** Keung, W.; Littenberg, L. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **28**: No. 5, 1067-1070(1 Sep 1983). Contract AC02-76CH00016.

The production of scalar electrons in e^-e^- collisions can proceed by exchange of a Majorana fermion, which is the photino in supersymmetric theories. Detection of this process will establish the self-conjugate nature of the photino and thus serve as a test of supersymmetry. Reactions of particular polarization configurations e/sub L/$^-$ e/sub L/$^-$ or e/sub R/$^-$ e/sub R/$^-$ are sensitive to the photino mass. We study the predicted cross sections and the event distributions.

6454 Field Theory

REFER ALSO TO CITATION(S) 56275, 56550, 56605, 56607, 56608, 56610, 56618

56620 **(DESY—83-009) Axial-vector anomaly for Dirac-Kaehler fermions on the lattice.** Goeckeler, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751030.

The axial-vector current of Dirac-Kaehler fermions on the lattice is studied. We consider a U(1) gauge theory in two dimensions as well as an SU(N) gauge theory in four dimensions. Using a short-distance expansion of the fermion propagator in an external gauge field, we show that the correct anomaly is reproduced in the continuum limit.

56621 **Operator-product expansion and the asymptotic behavior of spontaneously broken scalar field theories.** Taylor, C.; McClain, B. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] D: Particles and Fields;* **28**: No. 6, 1364-1371(15 Sep 1983). Contract AC02-76ER03069.

We reexamine a recent study of the operator-product expansion in spontaneously broken scalar field theories. First, the asymptotic behavior of the propagator in a spontaneously broken λphi⁴ theory is calculated to lowest nontrivial order. The use of the operator-product expansion in the "naive" vacuum, with operators developing nonvanishing vacuum expectation values, is found to correctly reproduce the usual perturbative analysis of the shifted theory when carried out to the same order. The renormalization-group improvement of this result is studied. We find that γ2, the renormalization-group coefficient of the operator phi², is nonzero at first order in λ. This contradicts the result of the study of Gupta and Quinn. The generalization of this analysis to all Green's functions at all orders in perturbation theory is outlined. We argue that the renormalization-group improvement of the perturbation theory should yield the same answer for the two methods of calculating the asymptotic limit. Finally, we discuss the implications of this study for gauge theories.

56622 **Phase structure of the O(N) vector model.** Bardeen, W.A.; Moshe, M. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 6, 1372-1385(15 Sep 1983).

In a large-N analysis of the O(N) λPhi⁴ theory in four dimensions, we find that the O(N)-symmetric lowest-lying state is a metastable state. The decay rate of this false vacuum into a broken-symmetry state is, however, suppressed [~exp(-N)]. Nevertheless, at finite temperature, we find that above a critical temperature T/sub c/ the only existing phase is a broken-symmetry phase with N-1 Goldstone bosons. This phase reflects the intrinsic instability of this theory, and the large-phi/sub c/ structure indicates that the renormalized λPhi⁴ theory is inconsistent. The only acceptable version of this theory is its regularized form which becomes a free-field theory as the regularization is removed.

56623 **Exact solution of the infrared problem.** Stapp, H.P. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 6, 1386-1418(15 Sep 1983). Contract AC03-76SF00098.

A simple but rigorous solution of the infrared problem is obtained. The basis of this solution is a factorization of the operator corresponding to the Feynman coordinate space plus all electromagnetic corrections to it into a product of two operators. The first is a unitary operator that represents precisely the contribution corresponding to classical electromagnetic theory. The second is a residual operator that is free of infrared problems. This factorization is exact: no soft-photon approximation, or any other approximation, is used. Both the unitary operator and the residual operator are expressed in simple forms amenable to rigorous mathematical analysis. The central technical result of this work, namely the exact yet simple organization of all contributions corresponding to classical physics into unitary factors, may have other important uses.

56624 **Lattice gauge theory in the microcanonical ensemble.** Callaway, D.J.E.; Rahman, A. (CERN, CH-1211, Geneve 23, Switzerland and High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 6, 1506-1514(15 Sep 1983). Contract W-31-109-ENG-38.

The microcanonical-ensemble formulation of lattice gauge theory proposed recently is examined in detail. Expectation values in this new ensemble are determined by solving a large set of coupled ordinary differential equations, after the fashion of a molecular dynamics simulation. Following a brief review of the microcanonical ensemble, calculations are performed for the gauge groups U(1), SU(2), and SU(3). The results are compared and contrasted with standard methods of computation. Several advantages of the new formalism are noted. For example, no random numbers are required to update the system. Also, this update is performed in a simultaneous fashion. Thus the microcanonical method presumably adapts well to parallel processing techniques, especially when the p action is highly nonlocal (such as when fermions are included).

56625 **Comment on "Upper bounds on the Higgs-Boson mass and the coupling constant".** Dicus, D.A.; Gleeson, A.M. (Center for Particle Theory, University of Texas, Austin, Texas 78712). *Physical Review Letters;* **51**: No. 4, 324-324(25 Jul 1983).

It is pointed out that the conditions used by Uchiyama can lead to additional values from the Higgs boson upper mass limit.

56626 **Obtaining Msub(W)-Msub(Z) cos theta in technicolor theories.** Grady, M. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Nuclear Physics* [*Section*] *B;* **221**: No. 1, 16-28(4 Jul 1983).

We show that the successful relation Msub(w) = Msub(z) cos theta is preserved in the technicolor formulation of the dynamical Higgs mechanism provided only that the creation operators for Goldstone bosons associated with broken generators belong to the Isub(w)=1/2 representation of the weak isospin group. We present a plausibility argument that this is indeed the case. No additional isospin or isospin-like global SU(2) symmetries are then required allowing isospin to be spontaneously broken. This may be of help in producing a large msub(c)/msub(s) splitting. It is also shown how the weak hypercharge interaction can produce substantial vacuum isospin breaking in a theory which is only marginally asymptotically free. This mechanism predicts msub(ν)μ/msub(μ)approx.=(msub(s)/msub(c))³, providing a natural explanation for small neutrino masses.

56627 **Generalized actions in Zsub(p) lattice gauge theory.** Creutz, M.; Okawa, M. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Physics* [*Section*] *B;* **220**: No. 2, 149-166(27 Jun 1983).

In Zsub(p) lattice gauge theory we generalize the Wilson action to include all group representations. We review the implications of duality for these models. With Monte Carlo methods, we find a rich phase structure for the cases p=4 and 5.

56628 **Geometric hierarchy.** Dimopoulos, S. (Harvard Univ., Cambridge, MA (USA). Lyman Lab. of Physics); Raby, S. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Nuclear Physics* [*Section*] *B;* **219**: No. 2, 479-512(20 Jun 1983).

Also published in "Third workshop on grand unified unification", Boston, MA (USA), Birkhaeuser, 1982, p. 72-88.

We present one approach for solving the gauge hierarchy problem in a grand unified supersymmetric theory. Supersymmetry is broken at a scale of order 10^{12} GeV. Both the grand scale (proportional10^{19} GeV) and the weak scale are generated via radiative corrections. The main phenomenological features of the model are: (i) the proton decays into $K^0\mu^+$ and K^+anti vsub(μ) and the neutron decays into K^0anti vsub(μ); (ii) the strong CP problem is solved with an invisible axion; (iii) the superpartners of quarks, leptons, gauge and Higgs bosons have masses proportional50-100 GeV; and (iv) the lightest superpartner is stable.

56629 **New strong-coupling expansion for quantum field theory based on the Langevin equation.** Bender, C.M. (Washington Univ., St. Louis, MO (USA). Dept. of Physics); Cooper, F. (Los Alamos National Lab., NM (USA). Theoretical Div.); Freedman, B. (Illinois Univ., Urbana (USA). Dept. of Physics). *Nuclear Physics* [*Section*] *B;* **219**: No. 1, 61-80(13 Jun 1983).

We review the connection between quantum field theory in d dimensions and a set of classical Langevin equations in d+1 dimensions. We then present a new method for solving these Langevin equations in the strong-coupling domain. For the special case of supersymmetric quantum mechanics (d=1) the Langevin equations are also in d=1 and we use our method to calculate the strong-coupling approximation to the ground-state energy of supersymmetric quantum mechanics when the superpotential is f(s)=1/4 gx^4. Our numerical results are accurate and they indicate that by studying the critical index of a lattice series one can determine whether the ground-state energy is zero and thereby see the signal of supersymmetry restoration or breaking in the continuum limit.

56630 Physics of dual vortices and static baryons in 2+1 dimensions. Snyderman, N.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics [Section] B;* **218**: No. 2, 381-422(6 Jun 1983).

With 31 refs.

The dual to Mandelstam's SU(N) models of magnetic confinement, which explicity realize the superconducting phase of the SU(N) gauge theory, are constructed and shown to explicitly realize 't Hooft's physical picture of the confining phase in 2 + 1 dimensions, in which electric vortices are Bloch walls between Zsub(N)sup(*) magnetic domains. These models generalize Polyakov's SU(2) -> U(1) compact QED model to SU(N) -> U(1)sup(N-1). These models have also been considered by Wadia and Das. Static baryons in SU(3) are studied. A hamiltonian analysis of the physics of confinement in these models is used to ellucidate the beautiful correspondence of Hosotani, that the electric vortex in the Polyakov model is related to the naive dual of a magnetic vortex in the insulating layer of a Josephson junction.

56631 Error estimate for the valence approximation to lattice QCD. Duffy, W. (Indiana Univ., Bloomington (USA). Dept. of Physics); Guralnik, G. (Los Alamos National Lab., NM (USA). Theoretical Div.); Weingarten, D. (Brown Univ., Providence, RI (USA). Dept. of Physics). *Physics Letters, [Section] B;* **125**: No. 4, 311-316(2 Jun 1983).

A Monte Carlo algorithm is used to calculate msub(N)/msub(rho), msub(Δ)/msub(rho), msub(q)msub(rho)/msub(π)^2, fsub(π)/msub(rho), fsub(rho)/msub(rho) and Asub(mo) for lattice QCD with the number of flavors Nsub(f) of quarks contributing virtual loops given by zero, the valence approximation, and with Nsub(f) chosen, in effect to be -2. The difference between corresponding pairs of quantities with Nsub(f) of zero and Nsub(f) of -2 we take to be an estimate of the difference between the value for a realistic theory with Nsub(f) of +2 and for the approximate theory with Nsub(f) of zero. The changes in mass ratios and Asub(mo) are consistent with zero and typically (20 +- 20)% while decay constant ratios change by as much as (88 +- 24)%.

56632 Self dual solutions of the temperature SU(2) Yang-Mills theory. Actor, A. (Department of Physics, The Pennsylvania State University, Allentown Campus, Allentown, Pennsylvania 18051). *Annals of Physics (New York);* **148**: No. 1, 32-56(Jun 1983). Contract AC02-79ER10528.

Continuing previous work we elaborate on the method of "heating" the self-dual axially symmetric fields of the SU(2) Yang-Mills theory to finite temperature. Heating consists of performing-in certain Ansatz functions which are two-dimensional (2D) conformally invariant- a 2D conformal transformation $x = x_0 + i'x' \to y(x)$, where the analytic function y(x) is periodic in the Euclidean time variable x_0. Solutions are preserved by this manipulation, which automatically changes zero-temperature fields into finite temperature ones. One can exploit this simple fact in various ways. The Harrington-Shepard caloran solution of the temperature Yang-Mills theory can be gotton from the T = 0 instanton by the transformation $y(x) = (\pi T)^{-1} \tan \pi Tx$. One can generate a multicaloron solution from the T = 0 one instanton solution by a conformal transformation. Generally, self-dual axially symmetric Yang-Mills fields can be heated without spoiling self duality. The caloron and three other temperature solutions can be studied in some detail. One of the new solutions is a generalized caloron with interesting properties. Our study reveals a remarkable property of the self-dual sector of the temperature Yang-Mills theory; it is full of Wu-Yang (color) monopoles at high temperature. At low temperature these monopoles disappear.

56633 Asymptotic estimate of large orders in perturbation theory for the many-fermion ground state energy. Baker, G.A. Jr.; Pirner, H.J. (Theoretical Divisions, Los Alamos National Laboratory, Los Alamos, New Mexido 87545 and Institut fuer Theoretische Physik and Max-Planck- Institut fuer Kernphysik, Heidelberg, Federal Republic of Germany). *Annals of Physics (New York);* **148**: No. 1, 168-191(Jun 1983). Contract W-7405-ENG-36.

The perturbation expansion of the ground-state energy of a many-fermion system interacting via a repulsive boson is investigated. The large-order behaviour of this series is related to the instanton solution of the effective boson Lagrangian. It is determined by the collapsed state of the system, where all fermions are in a volume determined by the Compton-wavelength of the boson. The series is only weakly diverging because of cancellations. The Borel and Borel-Pade resumations of the series are indicated.

56634 Light composite supermultiplets. Taylor, T.R. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters, [Section] B;* **125**: No. 2/3, 185-189(26 May 1983).

It is argued that in a wide class of massless strongly interacting supersymmetric gauge theories there exist confining phases with unbroken supersymmtry. We explain how to identify and interpret the light composite supermultiplet content of these phases.

56635 Field theory in elementary particles. Perlmutter, A. (ed.). New York, NY; Plenum Publishing Corporation (1983). 458p. (DOE/ER/40052—1; CONF-820142—Vol.1). Plenum Publishing Corp., 233 Spring Street, New York, NY 10013. Contract FG05-82ER40052.

From 19. Orbis scientiae meeting; Coral Gables, FL, USA (18 Jan 1982).

Separate abstracts were prepared for the 27 papers presented. (WHK)

56636 Gauge dependence of renormalization constants. Beven, T.P. Sandy Bay, Australia; Tasmania University (1981). vp. University Library.

Thesis.

This thesis presents a complete, self-contained list of the renormalization constants in unified gauge models to second order in the gauge coupling constant for four gauge choices. These are the Lorentz covariant gauges, the axial and Coulomb gauges, and a general non-covariant gauge. Specific details of the calculation of the one-loop infinities are provided. It is thus possible to explicitly verify the Ward-Slavnov-Taylor identities to this order. Comparisons are made which suggest parallelisms between the non-covariant gauges and certain covariant gauges. For instance, the infinities in the axial gauge are exactly what one would find in the Lorentz gauge with c = -3. For every Lorentz gauge an 'equivalent' non-covariant gauge is presented.

65 PHYSICS RESEARCH

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 55843, 56129, 56577, 56578

56637 (DOE/ER/02853—19) Nuclear-structure studies by the scattering of medium-energy electrons. Progress report, November 1, 1982-August 31, 1983. Peterson, G.A.; Hicks, R.S. (Massachusetts Univ., Amherst (USA). Dept. of Physics and Astronomy). Sep 1983. Contract AC02-76ER02853. 48p. NTIS, PC A03/MF A01. Order Number DE84000604.

During the past ten months the Medium Energy Nuclear Physics Group of the University of Massachusetts has continued to utilize the excellent experimental facilities of the Bates Electron Linear Accelerator Laboratory for electron scattering measurements on nuclei. The keystone in these measurements is the unique 900 MeV/c electron spectrometer, an instrument unequalled in its resolution. High beam currents may be used when the incident beam is dispersed on the target so that its momentum spread matches the momentum dispersion of the spectrometer. Thus in turn, small cross sections at high momentum transfers may be measured in reasonably short times because of the high beam intensities. Completed, ongoing, and planned experiments are described. (WHK)

56638 **(DOE/ER/40016—2-Pt.1) Intermediate-energy nuclear physics. Task C. Technical progress report, October 1, 1982-October 1, 1983. Part I.** (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). 1 Oct 1983. Contract AC02-81ER40016. 61p. NTIS, PC A04/MF A01. Order Number DE84000055.

Portions are illegible in microfiche products.

Progress is reported on the following experimental studies: (1) excitation of giant resonances in ^{118}Sn in inelastic pion scattering at 130 MeV; (2) giant dipole excitations of ^{40}Ca by inelastic pion scattering; (3) charge symmetry test using the π^+ and π^- elastic scattering from deuterium at 143 and 256 MeV; (4) binding energy effects on the isospin amplitudes in p-shell nuclei; (5) the energy dependence of the ^{14}C $(\pi^+,\pi^0)^{14}$N reaction to the IAS; (6) the (^{3}He,t) reaction at 2 GeV; (7) analyzing power in the (polarized p,n) IAS transitions; (8) the excitation of the 1/2$^+$ (2.36) MeV state in the 24Mg (polarized p,d) reaction from 27 to 150 MeV; (9) the energy dependence of the (polarized p,d) reaction for ^{54}Fe and ^{140}Ce; and (10) the energy dependence of the ^{7}Li(p,d)^{6}Li reaction. Publications are listed. (WHK)

56639 **(JAERI-M—83-145) Japanese list of request for nuclear data.** Igarasi, S. (comp.). (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Japanese Nuclear Data Committee). Sep 1983. 50p. (INDC(JAP)—80/G; NEANDC(J)—93/AU). Information Section, Division of Technical Information, Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan.

WRENDA Group of Japanese Nuclear Data Committee was convened in November 1982 to screen new requests, to examine the old Japanese requests and to compile Japanese List of Requests for Nuclear Data in 1982. About 20 new requests were received by the WRENDA Group, and were examined whether or not they were appropriate to the requests from the viewpoint of the present status of the nuclear data. When questions arose about the requests, the WRENDA Group asked the requestors the reasons behind their requests and discussed with them the questionable matters of their requests. In some cases, the WRENDA Group modified partly the descriptions of the original requests so that they might fit the status quo of the data. Finally, the WRENDA Group adopted 12 requests for fission reactors, 3 for fusion reactors and 2 for other purposes. The old requests were returned back to the requestors and were reviewed in the light of the data status and needs. The nuclear reaction data requested from fusion branch were mostly withdrawn. The data satisfies these requests, and 19 requests for fusion reactors were deleted. For safeguards, 27 requests were withdrawn. Most of them are rather old, and are already satisfied. For fission reactors, there are still constant requests, and only 13 old requests were deleted. In the present review work, 59 requests were finally withdrawn. Hence, a total of 123 Japanese requests will be registered in WRENDA. These requests are presented in the form of the computer output lists.

56640 **(KFK—3491) Results of research and development work in 1982 of the Institut fuer Angewandte Kernphysik.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik). Feb 1983. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751014.

The Institute for Applied Nuclear Physics is presently pursuing basic research-and application-oriented work in the two fields of nuclear solid-state physics and nuclear physics. In the field of solid-state physics the experimental and theoretical work has the purpose of better understanding the microscopic and macroscopic properties of certain solids. At present superconductors with high transition points, amorphous substances and alloys of transition metals and rare earths are investigated with special intensity. The work in nuclear physics concerns on the one hand, the investigation of the local and impulse distribution of nucleous or nucleon groups in nuclei. For this purpose nuclear reactions are investigated at the cyclotron in Karlsruhe and laser-spectroscopic methods are applied to small amounts of radioactive isotope substances. On the other hand, neutron capture cross-sections are measured which are important to understand the element assembly in stars. For the Core Material Control Project one group is developing measuring instruments by means of which the isotope composition and the concentration of fission products can be determined very precisely.

56641 **(NEANDC(E)—229-U) Progress report of the Neutron and Nuclear Physics Division for the year 1982.** (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). May 1983. 188p. (In French and English). (CEA-N—2343; INDC(FR)—58/U). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84900053.

This progress report gives a presentation of the nuclear physics work carried out in the Service de Physique Neutronique et Nucleaire (C.E. Bruyeres-le-Chatel) during the year 1982. It comprises a part about technical work and equipments and a second part on experiments and their interpretations. The third part is devoted to nuclear data evaluations and processing along with theoretical work. At the end of the report a list is given of the documents issued during the year 1982 and a list of talks given in the laboratory.

56642 **(PB—83-200808) National Institute for Nuclear Physics and High Energy Physics, section k - annual report January 1981-June 1982.** (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). Jun 1982. 119p. NTIS, PC E06/MF E01.

Contents: Electron scattering; Physics with pions, muons and baryons; Theory; Radio- and nuclear chemistry; MEA technical departments.

6511 Experimental Techniques

56643 **Principles of resonance-averaged gamma-ray spectroscopy.** Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). pp 342-355 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

An analysis of the resonance-averaged capture technique in gamma spectroscopy is presented to establish the spin-parity assignments derived from this method on a quantitative basis. A historical description of the technique and its applications is given and the principles of the method are stated. A method of statistical analysis is described and the results are applied to some recent measurements.

56644 **Selected topics in thermal- and resonance-neutron capture.** Raman, S. (Oak Ridge National Lab., TN (USA)). pp 357-374 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

Several topics of current interest are discussed including energy and intensity standards, direct thermal neutron capture, primary E2 transitions in (n,γ) reactions, nonstatistical effects in resonance neutron capture, transmission measurements of Sc employed in 2-keV facilities, and tests of Axel-Brink predictions of γ-ray strength functions via average resonance capture.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 56585, 56637

56645 **Quark distributions in nuclei.** Carlson, C.E.; Havens, T.J. (Physics Department, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review Letters;* **51**: No. 4, 261-263(25 Jul 1983). Contract AC02-76ER13001.

Recent deep-inelastic lepton-scattering data from iron and deuterium targets are interpreted from a quark-model viewpoint as evidence for a significant number of six-quark clusters in iron. Standard expectations for the distribution of quarks within a six-quark cluster give some quantitative success in describing the data.

56646 Computer program for nuclear reaction analysis with the D(^{3}He,α)H reaction. Marcuso, T.L.M.; Rothman, S.J.; Nowicki, L.J.; Baldo, P. (Argonne National Lab., IL (USA). Materials Science Div.). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 1, 227-229(1 Jun 1983).

Letter-to-the-editor.

A computer program for nuclear reaction analysis (NRA) by the D(^{3}He, α)H reaction in the energy analysis mode is presented. Multiple scattering effects are explicitly included.

56647 Three-nucleon interaction in 3-, 4- and infinite-body systems. Carlson, J.; Pandharipande, V.R. (Illinois Univ., Urbana (USA). Dept. of Physics); Wiringa, R.B. (Argonne National Lab., IL (USA). Physics Div.). *Nuclear Physics* [*Section*] *A;* **401**: No. 1, 59-85(30 May 1983).

With 35 refs.

We report results of variational calculations of ^{3}H, ^{3}He, ^{4}He and nuclear matter with the Urbana upsilon$_{14}$ two-nucleon interaction and realistic models of the three-nucleon interaction (TNI). These include the Tucson and isobar intermediate-state models of the two-pion exchange TNI. The latter is also studied with an intermediate-range three-nucleon repulsion. In general, realistic TNI helps to bring the theory closer to experiment by giving extra binding energy to the A = 3 and 4 nuclei and providing extra saturation to the nuclear matter binding energy. The Coulomb energy of ^{3}He and the rms radii of A=3,4 nuclei are also well described. However, some problems remain unresolved. There is a slight overbinding of ^{4}He, and underbinding of nuclear matter, and the charge form factors of ^{3}He and ^{4}He, calculated with impulse approximation, deviate from the experimental at $q^2 > 5$ fm^{-2}.

56648 Interplay between two- and three-body interaction in light nuclei and nuclear matter. Wiringa, R.B. (Argonne National Lab., IL (USA). Physics Div.). *Nuclear Physics* [*Section*] *A;* **401**: No. 1, 86-92(30 May 1983).

A recent study of different models of three-nucleon interaction (TNI) in ^{3}He, ^{3}H, ^{4}He and nuclear matter is extended to study the influence of different choices of the accompanying two-body interaction. A new two-body potential, Argonne upsilon$_{14}$, is coupled with both the Tucson and isobar intermediate-state models of two-pion-exchange TNI, with a phenomenological intermediate-range repulsive TNI added to the latter. Variational calculations are carried out for these systems, and compared to the earlier work. We find that a stronger tensor component in the two-body potential, as typified by a larger deuteron D-state percentage, gives more attraction for the TNI, counteracting the saturation effect obtained when only two-body forces are considered.

6513 Nuclear Properties And Reactions, A=6-19

56649 (DOE/ER/40016—2-Pt.2) Intermediate-energy nuclear physics. Task W. Technical progress report, February 1-October 1, 1983. Part II. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). 1 Oct 1983. Contract AC02-81ER40016. 32p. NTIS, PC A03/MF A01. Order Number DE83017748.

Portions are illegible in microfiche products.

This report summarizes work carried out at the Nuclear Physics Laboratory of the University of Colorado from February 1, 1983 to October 1, 1983 under DOE Contract DE-AC-81ER-40016 (Task W). A large fraction of this work was carried out at the University of Colorado including neutron detector modelling, design, construction and testing. Analysis of data, theoretical calculations, scattering chamber design, and analysis of the capabilities of the accelerator and time-of-flight spectrometer at Los Alamos were also done at Colorado. Development of the flight path, detector hut, light fiber signal link, data acquisition system, target wheel and beam line were done at Los Alamos largely by Los Alamos personnel. Data acquisition was carried out at Los Alamos. Observation of Fermi and Gamow-Teller strength in the 800 MeV ^{13}C(p,n)^{13}N reaction is reported. (WHK)

56650 Elastic and inelastic scattering of 120 MeV ^{18}O from ^{208}Pb and the spin alignment of the 2$^+$ state of ^{18}O. Gross, E.E.; Beene, J.R.; Erb, K.A.; Fewell, M.P.; Shapira, D.; Rhoades-Brown, M.J.; Satchler, G.R. (Oak Ridge National Lab., TN (USA)); Thorn, C.E. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Physics* [*Section*] *A;* **401**: No. 2, 362-396(6 Jun 1983).

With 49 refs.

The elastic and inelastic scattering of ^{18}O ions at 120 MeV from a target of ^{208}Pb have been studied. Cross sections for excitation of the 2$^+$ state at 1.982 MeV in ^{18}O and of the 3$^-$ state at 2.61 MeV in ^{208}Pb were measured. In addition, the populations of the m-substates for the ^{18}O excitation were deduced from the Doppler-broadened line shapes. The data were subjected to a coupled-channels analysis using either Woods-Saxon or folding-model potentials. In addition, the ^{18}O excitation was found to be described very well by use of a semi-microscopic model. The analyses consistently indicated the presence of a positive static hexadecapole moment of several exfm^4 for the 2$^+$ state of ^{18}O. The m-substate population distributions were found to be better fitted if a vector spin-orbit coupling was introduced for the 2$^+$ state of ^{18}O with a sign opposite to that for the nucleon-nucleus case.

6514 Nuclear Properties And Reactions, A=20-38

56651 Direct capture in the ^{34}S(n,γ)^{35}S reaction with thermal neutrons. Carlton, R.F. (Middle Tennessee State Univ., Murfreesboro (USA)); Raman, S. (Oak Ridge National Lab., TN (USA)); Jurney, E.T. (Los Alamos National Lab., NM (USA)). pp 375-376 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The partial capture cross sections for primary γ-rays in the ^{34}S(n,γ)^{35}S reaction with thermal neutrons are measured and compared with direct capture predictions.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 56645

56652 (KFK—3378) Optical potentials and isoscalar transition rates from 104 MeV alpha-particle scattering by the N=28 isotopes ^{48}Ca, ^{50}Ti and ^{52}Cr. Friedman, E.; Pesl, R.; Gils, H.J.; Rebel, H.; Buschmann, J.; Klewe-Nebenius, H.; Zagromski, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie). Feb 1983. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751005.

Precisely measured differential cross sections for elastic and inelastic scattering from 104 MeV alpha-particles by ^{48}Ca, ^{50}Ti and ^{52}Cr are reported. The analyses aim primarily at the determination of strength, radial shapes and deformation of the scattering potentials, looking for isotonic differences of N = 28 isotones. The mean square radii of the (real) potentials are discussed in terms of mean square radius differences of the matter distributions. The isoscalar transition rates derived by coupled channel analyses of the measured cross sections are compared with electromagnetic rates. In addition to the analyses on the basis of a slightly generalized extended optical model a semi-microscopic deformed folding model has been applied, using a density-dependent effective alpha-bound nucleon interaction. Though an excellent description of the data over the full angular range is obtained the resulting values of the deformation parameters appear to be not consistent with results from various different methods.

56653 Research highlights from the Holifield Heavy Ion Research Facility. Plasil, F. (Oak Ridge National Lab., TN (USA)). *Nuclear Physics* [*Section*] *A;* **400**: 417c-433c(23 May 1983). (CONF-820979—). Contract W-7405-ENG-26.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

The purpose of this paper is to present the scope of research carried out at the new Holifield Heavy Ion Research Facility (HHIRF) at Oak Ridge. In Section 2 a brief description of HHIRF will be given, together with its current status. Section 3 will be devoted to microscopic aspects of reactions between nuclei, with reference to the prospects for the study of giant resonances by means of heavy ions, and to studies of elastic and inelastic scattering of ^{60}Ni nuclei. Macroscopic aspects of nuclear reactions will be illustrated in Section 4 by means of the study of collisions between ^{58}Ni nuclei at 15.1 MeV/u and by means of Spin Spectrometer (crystal ball) studies of the ^{19}F + ^{159}Tb reaction. In Section 5 results will be presented for lifetime measurements of high-spin states in ytterbium nuclei.

6516 Nuclear Properties And Reactions, A=59-89

56654 **Gamma-ray decay of levels in ^{63}Cu and ^{65}Cu.** Dickens, J.K. (Oak Ridge National Lab., TN (USA)). *Nuclear Physics [Section] A;* **401**: No. 2, 189-210(6 Jun 1983).

Gamma-ray decay of levels in the stable copper isotopes ^{63}Cu and ^{65}Cu has been studied using sup(63,65)Cu(n,n'γ) reactions for incident neutron energies between threshold and 6 MeV. Of the 257 γ-rays or γ-ray groups observed for neutron interactions with ^{63}Cu, 137 have been placed or tentatively placed among 88 levels in ^{63}Cu up to an excitation energy of 5.9 MeV. Similarly, of 335 γ-rays or γ-ray groups observed for neutron interactions with ^{65}Cu, 127 have been placed among 100 levels in ^{65}Cu up to an excitation energy of 5.8 MeV, including new decay data for > 70 excited states of ^{65}Cu.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 56638, 56663, 56676, 56676

58655 **(DOE/ER/02696—19) Neutron cross section measurements using the ORELA: ^{40}Ar(n,x), ^{40}Ca(n,x), ^{22}Ne(n,γ), ^{187}Os(n,n') $^{186\ 187\ 188}$Os(n,nn'γ), the stable tellurium isotopes (n,γ), and ^{205}Tl(n,nγ). Progress report, September 1, 1982-August 31, 1983.** Winters, R.R. (Denison Univ., Granville, OH (USA)). Sep 1983. Contract AC02-76ER02696. 12p. NTIS, PC A02/MF A01. Order Number DE83017466.

The research performed during this reporting period consisted primarily of (1) measurement, analysis, and publication of the ^{187}Os(n,n') cross section near 30 keV, (2) measurement and analysis of the $^{148\ 149\ 150}$Sm(n,γ) cross sections, (3) development and publication of a significantly better approximation to the average neutron scattering function as determined by total cross section measurements at the Oak Ridge Electron Linear Accelerator (ORELA), and (4) providing support for the neutron capture facility at ORELA as in the corrections made to the ^{60}Ni(n,γ) data discussed in a paper included with this report. The major result of the ^{187}Os(n,n') cross section measurement was the 30 keV average value for that cross section anti σ/sub nn'/ ≅ 1.5 +- 0.2 b and the implication that the duration of stellar nucleosynthesis, as derived from the ^{187}Re → ^{187}Os beta decay, is estimated to be (8.9 +- 2.0) x 10^9 year consistent with an earlier estimate reported by Winters and Macklin. The Sm(n,γ) measurement has already resulted in an estimate of the importance of branching in the s-process in the samarium mass region. We estimate the average neutron density during s-process nucleosynthesis in the vicinity of the solar system to be between ≦ (1.1 + 0.7) and (1.1 - 0.6) x 10^8 neutrons/cm^3. In the optical model analysis of neutron total cross sections we continue to find that orbital angular momentum dependent well depths are required if the spherical optical model is used to describe the neutron-nucleus interaction at low neutron energies.

58656 **(FRNC-TH—1128) Simulation study of proton inelastic interaction with nuclei in the 50 to 350 MeV range by Monte Carlo Method.** Peres, J.C. (Toulouse-3 Univ., 31 (France)). Nov 1982. 107p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703482.

Thesis.

This study settles a contribution to the proton-nucleus inelastic interaction simulation. Experimental display of deuteron, triton, ion ^{3}He and alpha clusters in nucleus led us to include them in intranuclear cascade. We use a FERMI type distribution of nucleons; knowledge of each fundamental phenomenon allowed us to follow every particle moving in the medium. Inelastic interaction simulation was performed by the use of a MONTE CARLO method.

58657 **(INIS-mf—8479, pp 156) L3 Photonuclear reactions.** 1981. NTIS (US Sales Only), PC A08/MF A01.

In Nondestructive gamma activation analysis of mineral materials.

Photonuclear reactions are divided according to the energy of gamma quanta. At low energies (10^1 to 10^2 keV) resonance scattering occurs. The study and use of this phenomenon falls under Moessbauer spectroscopy. At energies of 7 to 8 MeV inelastic scatterring occurs. The reactions are of a photoexcitation type and produce a number of important isomers. At energies of 7 to 22 MeV photodisintegration reactions take place. In the region of 22 to 25 MeV more complex reactions take place of the type (\,xn), (\,2p), (\,p+xn), (\,chemical bond+p), (\,chemical bond+xn) as do spallation and splitting reactions. (J.B.).

58658 **(LA-UR—83-2531) Polarization phenomena in N-nucleus scattering.** Moss, J.M. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 17p. (CONF-8307100—1). NTIS, PC A02/MF A01. Order Number DE83017317.

From TRIUMF workshop on studying nuclei with medium energy protons; Alberta, Canada (11 Jul 1983).

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Polarization observables will play an increasingly important role in future studies of nuclei with medium-energy (ME) protons. This may be stated without much chance of future contradiction. Beyond that, however, it is impossible to foresee. There are many issues in nucleon-nucleus physics that could be dramatically affected. Current examples of polarization experiments are presented, and two future experiments in which qualitatively new information will be obtained are discussed. The emphasis here is on physics that cannot be obtained from other hadronic or electromagnetic experiments.

58659 **Parabolic energy dependence of odd-odd multiplets in N=83 nuclides.** Walters, W.B.; Chung, C. (Maryland Univ., College Park (USA). Dept. of Chemistry); Brenner, D.S.; Aprahamian, A. (Clark Univ., Worcester, MA (USA). Dept. of Chemistry); Gill, R.L.; Chrien, R.E.; Shmid, M.; Wolf, A.; Yuan, L.J. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.). *Physics Letters, [Section] B;* **125**: No. 5, 351-355(9 Jun 1983).

The splitting and the displacement of low-lying πsub(g7/2)νsub(f7/2) and πsub(d5/2)νsub(f7/2) multiplets in the odd-odd N = 83 isotones are found to be described by a quadrupole interaction between the odd proton and odd neutron. The quenching and inversion of the πsub(d5/2)νsub(f7/2) parabola is found to arise from the quasiparticle blocking effect as the occupancy of the dsub(5/2) orbital changes.

58660 **^{135}Ba(n,γ)^{136}Ba reaction.** Schreckenbach, K.; Faust, H.; Davidson, W.F. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Blakeway, S. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France); Manchester Univ. (UK)); Gelletly, W.F. (Manchester Univ. (UK)); Casten, R.F.; Warner, D.; Stelts, M.F. (Brookhaven National Lab., Upton, NY (USA)). pp 200-201 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The γ-ray spectra from the capture of 2 keV and 24 keV neutrons on ^{135}Ba have been studied at Brookhaven National Laboratory. The spectrum of γ-rays and parts of the conversion electron spectrum from the capture of thermal neutrons on ^{135}Ba have been

studied with GAMSI/II and the BILL electron spectrometer at the HFR, I.L.L. Some preliminary results are reported here.

56661 Statistical compared with valence-neutron capture in ^{98}Mo. Gardner, D.G. (Lawrence Livermore National Lab., CA (USA)). pp 316-318 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The ^{98}Mo + n reaction is examined for neutrons in the 1 keV to 3 MeV range in order to test the widely reported result that in mass regions corresponding to peaks in the neutron strength function nonstatistical mechanisms contribute a significant or even major portion of the average width in the beginning of the resonance region. Preliminary calculations are presented which suggest that these nonstatistical effects rapidly disappear when measurements from even a small number of resonances are averaged.

56662 Use of oxide targets in 2 keV average neutron-capture measurements. Tang, J.S.; Raman, S. (Oak Ridge National Lab., TN (USA)). pp 377-378 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

Large samples (approx. = 10-100 grams) are usually required for 2-keV filtered-beam measurements and such samples invariably come in the oxide form. Monte Carlo calculations show that the resulting neutron spectrum is degraded by approx. = 0.2 keV in a $^{148}Nd_2O_3$ sample. Otherwise, oxide samples are acceptable for such measurements.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 56551, 56653, 56653, 56655

56663 (CONF-820828—11) Evolution of nuclear shapes in $^{157-161}$Yb as a function of spin and neutron number. Jaeaeskelaeinen, M.; Sarantites, D.G.; Dilmanian, F.A.; Woodward, R.; Puchta, H.; Beene, J.R.; Hattula, J.; Halbert, M.L.; Hensley, D.C.; Barker, J.H. (Oak Ridge National Lab., TN (USA); Washington Univ., St. Louis, MO (USA). Dept. of Chemistry). 1982. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE84000410.

From 9. EPS Nuclear Physics Divisional conference on nuclear structure; Amsterdam, Netherlands (29 Aug 1982).

The population distributions of the entry states, the entry lines <E*> versus multiplicity, the energy spectra and the angular distributions of the continuum γ-rays as a function of multiplicity in $^{157-161}$Yb from the reactions of 136 MeV and 149 MeV ^{20}Ne with ^{144}Nd and ^{146}Nd have been investigated with a 4pi multidetector system gated with a Ge detector. The observed entry lines and γ-decay modes indicate change for N = 87 - 91 Yb isotopes suggests an evolution of nuclear shapes from prolate at low spins to particle aligned oblate structure for ^{157}Yb and ^{159}Yb followed by the onset of high-K bands built on largely deformed oblate states at increasingly higher spin between 38 and 50 n with increasing neutron number for $^{157-161}$Yb. Furthermore evidence for an evolution to triaxial shape at I $\simeq$ 50 for ^{159}Yb was found. 23 references.

56664 Identification of O^+ bands from ARC spectroscopy in ^{164}Dy. Warner, D.D.; Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). pp 224-226 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The location of low lying O^+ bands represents a crucial feature in any attempt to understand the collective structure of deformed nuclei in terms of either macroscopic or microscopic frameworks. However, the data which exist to date of ^{164}Dy fail to identify any O^+ bands below an excitation energy of 2 MeV. Using average resonance capture techniques and the knowledge that the subset of states with Jsup(π) = 1^+ - 4^+ is complete the possible location of O^+ bands is suggested. The ^{163}Dy(n,γ)^{164}Dy reaction is studied with mean neutron energies of 2 and 24 keV.

56665 Study of ^{184}W by average resonance capture. Casten, R.F.; Warner, D.D. (Brookhaven National Lab., Upton, NY (USA)); Brentano, P. von; Schiffer, K. (Koeln Univ. (Germany, F.R.). Inst. fuer Kernphysik). pp 234-235 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

^{183}W(n,γ)^{184}W average resonance capture has been performed to get a complete set of 0^+, 1+, and 2+ states below 2.3 MeV of ^{184}W for a comparison with IBA calculations.

56666 Curved-crystal study of de-excitation gamma rays in ^{184}W following neutron capture. Davidson, W.F. (National Research Council of Canada, Ottawa, Ontario. Div. of Physics; Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); Reich, C.W.; Greenwood, R.C. (Idaho National Engineering Lab., Idaho Falls (USA)); Koch, H.R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). pp 236-237 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

Earlier studies of the ^{184}W level scheme from radioactive decay of the two ^{184}Re isomers and from the ^{183}W(n, γ) reaction have provided a rather detailed picture of the rotational-band structure of this nucleus in the region below equivalent to 2 MeV. One of the interesting features to emerge from these studies was the observation of low-energy γ rays which could be assigned as transitions between excited positive-parity collective bands. To provide more definite information on these possible low-energy γ rays and hence to address the question of the existence of non-zero E2 matrix elements between the collective positive-parity bands in ^{184}W, the secondary γ-ray spectrum emitted following thermal-neutron capture in ^{183}W has been measured.

6519 Nuclear Properties And Reactions, A=190-219

56667 (INIS-mf—8504) Nuclear orientation experiments concerning odd-A gold isotopes. Ligthart, H.J. (Rijksuniversiteit Groningen (Netherlands)). 1 Oct 1982. 202p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE83703483.

Proefschrift.

This thesis describes nuclear spectroscopy aspects of nuclear orientation in the odd-A gold isotopes ^{191}Au, ^{193}Au, ^{195}Au and ^{197}Au. These isotopes lie in a transitional region between the spherical nuclei in the lead region and the strongly deformed rare earth isotopes. Following a general introduction to nuclear orientation, the experimental arrangement is described. A new technique is presented that applies in-beam recoil implantation inside the refrigerator itself and this was applied to the case of ^{191}Au. The three other gold isotopes were oriented using a conventional dilution refrigerator. The nuclear orientation experiments concerning $11/2^-$ isomers of the isotopes are described. The long-lived isomeric states were oriented using the large hyperfine field of gold in iron. Higher lying levels were studied by nuclear orientation of the Hg parent states.

6520 Nuclear Properties And Reactions, A=220 And Above

56668 (DOE/ER/13246—T1) Nuclear research with heavy ions. Annual progress report, January 1-December 31, 1983. Kaplan, M. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Chemistry). Sep 1983. Contract AC02-76ER13246. 77p. NTIS, PC A05/MF A01. Order Number DE84000876.

The research program is based upon experimental studies of reactions induced in complex nuclei by energetic heavy ion collisions. We are investigating the characteristics of different reaction modes or mechanisms and the transitions between them which depend on mass, charge, energy, and angular momentum in the entrance channels. In such interactions, highly excited transient nuclear systems may be produced and there is interest in probing their properties as reflectors of the behavior or nuclear matter under extreme conditions of temperature, density, and rotational forces. This report is intended to summarize the research progress in the past year and provides an overview of the continuing evolution in our experimental approach and theoretical understanding. Our work has emphasized the development and utilization of light-charged-particle emission as a dynamic probe of heavy-ion interactions through characteristic signatures which reflect nuclear shapes, effective temperatures, and spins.

56669 (NEANDC(E)—228-U) Results of coupled-channels calculations for the neutrons cross sections of a set of actinide nuclei. Lagrange, C. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Oct 1982. 124p. (INDC(FR)—56). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84900054.

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This report gathers recent results of neutrons interactions with the following actinide nuclei: ^{230,232}Th, ^{234,238}U, ^{242}Pu, ^{246}Cm and ^{252}Cf from the use of the coupled channels optical model. Tabulations of the following quantities are given in Annexe: (1) total, direct elastic and inelastic scattering (integrated and differential), and compound nucleus formation cross sections, and (2) ground state generalized transmission coefficients needed to calculate the cross sections of partial compound nucleus processes.

56670 Neutron-capture gamma-ray spectroscopic measurements in the actinide region. Hoff, R.W.; Lougheed, R.W. (California Univ., Livermore (USA). Lawrence Livermore National Lab.); Barreau, G.; Boerner, H.; Davidson, W.F.; Schreckenbach, K.; Warner, D.D.; von Egidy, T. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)); White, D.H. (Western Oregon State Coll., Monmouth (USA)). pp 250-262 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

From recent neutron capture gamma-ray measurements, experimental data for states involving quasiparticle-vibrational admixtures in ^{227}Ra, ^{231}Th, ^{233}Th, ^{235}U, ^{237}U, and ^{239}U have been compared with theoretical calculations by Soloviev's group. This analysis shows the experimental level structure is more complex than that calculated. In the levels of ^{250}Bk, four Gallagher-Moszkowski pairs are observed. The moment of inertia for each band with antiparallel alignment of odd-nucleon momenta is systematically larger than for its parallel-aligned mate.

56671 Excited levels of ^{238}Np from spectroscopic measurements of the reaction ^{237}Np(n,γ)^{238}Np and sup(242m)Am alpha decay. Hoff, R.; Ruhter, W.; Mann, L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.) (and others). pp 263-265 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The gamma rays and conversion electrons emitted following neutron capture in a ^{237}Np target have been measured by use of the GAMS and BILL spectrometers at Grenoble. Gamma ray and alpha particle measurements of sup(242m)Am alpha decay (Ge(Li)γ singles, γ-γ coincidences, α singles) have been made at Livermore. The data from these measurements have been combined with earlier measurements (Ionescu 1979, Asaro 1964) to produce a more detailed level scheme for ^{238}Np.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 56656

56672 (CONF-8308125—2) Three-body forces, relativistic effects, isobars, and pions in nuclear systems. Wiringa, R.B. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84000163.

From 3. international conference on recent progress in many-body theories; Altenberg, F.R. Germany (29 Aug 1983).

Conventional microscopic calculations in nuclear physics start from a nonrelativistic Hamiltonian. The many-body Schroedinger equation is then solved to obtain the ground state energy, wave function, and expectation values of other quantities of interest. Such a procedure gives a qualitative description of nuclear saturation properties, but it is now well established that the simple H is quantitatively inadequate. For example, the light nuclei are underbound with too large a charge radius, while nuclear matter is overbound at far too high a density. This note reviews recent studies that go beyond the simple H. These include 1) the introduction of three-nucleon potentials, 2) estimates of relativistic effects, 3) the introduction of isobar degrees of freedom in the two-body potential, and 4) probing the influence of pion degrees of freedom on nuclear systems. (WHK)

56673 (CONF-8308125—3) Coupled-cluster theory of pions in nuclear matter and the EMC effect. Coester, F. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84000162.

From 3. international conference on recent progress in many-body theories; Altenberg, F.R. Germany (29 Aug 1983).

The conventional theory of nuclei assumes that the interactions of nucleons are due to the exchange of mesons. The usual treatment eliminates the mesons at the outset in favor of two- and three-body potentials and two-body current densities (exchange current operators). There is no difficulty in formulating the many-body theory including mesons on the formal level, but the complexity of the formalism easily frustrates efforts to obtain reliable approximations of sufficient accuracy. High accuracy in the potential energies is essential for a significant calculation of binding energies since the latter are much smaller than the former. Recent measurements of deep-inelastic lepton scattering show a marked difference of the nuclear structure functions $F_2(x,Q^2)$ observed in iron and deuterium - the so-called EMC (European Muon Collaboration) effect. This discovery raises the possibility that pion densities in nuclei may be observed in these experiments and brings a new focus to the theory of pions in nuclei. It was generally assumed that deep-inelastic lepton scattering from a nucleus occurs off the constituents of nucleons whose structure is not affected by their environment. It is a conservative extension of this view to assume that the leptons may scatter either off the constituents of the nucleons or off the constituents of the mesons. Such a model requires nuclear wave functions including mesons and the connection between these wave functions and the structure function of the nucleus. The model is described.

56674 (DOE/ER/03992—516) Do pions condense in neutron-star matter. Wheeler, J.W.; Gleeson, A.M. (Texas Univ., Austin (USA). Center for Particle Theory). Apr 1983. Contract AS05-76ER03992. 24p. NTIS, PC A02/MF A01. Order Number DE84000463.

Pion condensates in neutron-star matter, formed either as new modes, or on states identifiable with those of the free pion are studied. A description of neutron-star matter at finite temperature is formulated upon a suitable basis of realistic interactions in a modified background field description, and leads to the onset of a pion condensate between the density of nuclear matter and the density of free hadrons. This condensate, however, is blocked when strange hadrons are incorporated in the description.

56675 (DOE/ER/40015—2) Theoretical nuclear physics. Task B. Technical progress report, August 1, 1982-September 30, 1983. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). 1 Oct 1983. Contract AC02-81ER40015. 39p. NTIS, PC A03/MF A01. Order Number DE84000054.

Progress is reported on the following studies: (a) double delta interactions in pion double charge exchange; (b) isovector correlations in pion-nucleus scattering; (c) nuclear structure effects in pion single charge exchange; (d) a perspective on sequential transfer reactions; (e) inelastic and charge exchange scattering theory; (f) magnitude of the first order DWBA description of the two nuclear transfer reactions; (g) nonlocality effects on deuteron transfer reactions; (h) evaluation of external radial integrals in inelastic electron scattering; (i) experimental observables as a function of Dirac invariant amplitudes; (j) Dirac shell-model wavefunctions in inelastic electron scattering; and (k) impulse approximation Dirac theory of inelastic proton nucleus collective excitations. Publications are listed. (WHK)

56676 (PNL-SA—11555) Double beta decay: recent developments and projections. Avignone, F.T. III; Brodzinski, R.L.; Brown, D.P.; Evans, J.C. Jr.; Hensley, W.K.; Reeves, J.H.; Wogman, N.A. (South Carolina Univ., Columbia (USA); Pacific Northwest Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76RL01830. 23p. (CONF-8306127—1). NTIS, PC A02/MF A01. Order Number DE84000476.

From 4. annual weak interactions conference; Philadelphia, PA, USA (1 Jun 1983).

A report of recent events in both theoretical and experimental aspects of double beta decay is given. General theoretical considerations, recent developments in nuclear structure theory, geochronological determinations of half lives and ratios as well as laboratory experiments are discussed with emphasis on the past three years. Some projections are given. 28 references.

56677 Nuclear collisions from AMeV to ATeV: From nuclear to quark matter. Gyulassy, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics [Section] A;* **400**: 31c-41c(23 May 1983). (CONF-820979—). Contract AC03-76SF00098.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

Also published as report LBL–15175, Oct 1982.

The maximum energy density achieved in nuclear collisions is estimated in this energy range. Stopping power and longitudinal growth are discussed. We show that for lab energies > 100 AGeV energy densities high enough to produce a plasma can be reached. Cosmic-ray data support these calculations and suggest a possible novel signature of the plasma phase transition.

56678 Continued study of the parameterization of the E1 gamma-ray strength function. Gardner, M.A.; Gardner, D.G. (Lawrence Livermore National Lab., CA (USA)). pp 319-321 of Neutron-capture gamma-ray spectroscopy and related topics 1981. von Egidy, T.; Goennenwein, F.; Maier, B. (eds.). Bristol, England; Institute of Physics (1982). (CONF-810920—).

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The parameterization of the magnitude and the energy dependence of the E1 gamma-ray strength function, fsub(E1)(Esub(γ)), for the calculation of neutron- and proton-induced capture cross sections and capture gamma-ray spectra has been further investigated.

6540 Radiation And Shielding Physics

56679 (DOE/ER/01198—1403) Momentum density of hcp and liquid helium-4 by inelastic neutron scattering. Hilleke, R.O. (Illinois Univ., Urbana (USA)). 1983. Contract AC02-76ER01198. 186p. NTIS, PC A09/MF A01. Order Number DE84000468.

Thesis.

A measurement of the momentum density in hcp and liquid ^{4}He by inelastic neutron scattering is reported. Using the Low Resolution Medium Energy Chopper Spectrometer at the Intense Pulsed Neutron Source at Argonne National Laboratory, momentum transfers in the range 12 to 22.5 A^{-1} were attained. At these momentum transfers, the momentum density of the sample is related to the dynamic structure factor by the impulse approximation. The measured momentum distribution is Gaussian and the kinetic energy is larger than proposed by existing theories. Data were taken on two solid samples, the first was a 19.45 cm^3/mole hcp solid, the second was 18.20 cm^3/ mole; both solid samples were maintained at 1.70 K during data collection. Data were also taken on a liquid sample with a molar volume of 18.20 cm^3/mole at 4.00 K. At 1.70 K the two solid samples are essentially in their ground states so that the measurement is of the ground state momentum density. The liquid sample was included to see if the difference between the liquid and solid momentum density at the same molar volume was observable.

56680 Electron energy degradation in neon. Singhal, R.P.; Rio, D.E.; Schippnick, P.F.; Green, A.E.S. (Univ. of Florida, Gainesville). *Radiation Research;* **95**: No. 1, 32-44(Jul 1983).

Spatial (radial and longitudinal) yield spectra for electron energy degradation in neon gas for 20 eV to 1 keV incident electrons are generated using a Monte Carlo technique. The differential elastic and inelastic scattering cross sections needed for these calculations are obtained from atomic independent particle models augmented by semiempirical modifications. Numerical four-dimensional yield spectra are represented analytically within the framework of a microplume model. Some special features of two-dimensional and four-dimensional yield spectra for a gas with a high threshold energy such as neon are discussed. Finally, yields of some prominent emission lines in neon are calculated and their spatial characteristics are represented by contour diagrams.

6550 Medical Physics

REFER ALSO TO CITATION(S) 56286

56681 (GSF-S—878) 1981 statistical results of the Official Personnel Dosimetry Service at GSF. Drexler, G.; Eckerl, H.; Haid, G.; Scheibe, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Auswertungsstelle fuer Strahlendosimeter). Dec 1982. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751001.

The report consists of a summary of relevant statistical data from the Official Personel Dosimetry Service in 1981. Under survey were occupationally exposed persons in the states of Bavaria, Hessen and Schleswig-Holstein. The data are based on the survey of 6 200 institutions with 58 000 persons and are derived from approx. 700 000 single measurements. The report covers informations on the institutions, on the persons as well as dosimetric values. The measuring method is described briefly with respect to dosimeters used, their range and the interpretation of values. Information on notional doses and the interpolation of values nearby the detection limits are given.

56682 Applications of track calculations to radiobiology. I. Monte Carlo simulation of proton tracks. Zaider, M. (Columbia Univ., New York, NY); Brenner, D.J.; Wilson, W.E. *Radiation Research;* **95**: No. 2, 231-247(Aug 1983).

In the first of a series of papers on the application of track-structure calculations to radiobiology, a detailed Monte Carlo proton transport code in water vapor is described. In the code all

important interaction types (elastic scattering, five levels of ionization, 12 types of excitation) are considered explicitly. All cross sections are based closely on experimental data. The proton energy range considered is 0.3 to 1.5 MeV since this is the range of available experimental ionziation cross sections. Results are presented in terms of energy partitions, w values, stopping powers, and radial dose distributions, all showing agreement with the experiment.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 56003, 56033, 56037, 56058, 56072, 56107, 56640

56683 (CONF-830573—8) Host-lattice effects in the spin-orbit fine structure of vacancy-trapped electrons. Smith, D.Y.; Harker, A.H. (Argonne National Lab., IL (USA); UKAEA Atomic Energy Research Establishment, Harwell). Sep 1983. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01. Order Number DE84000599.

From 2. international conference on radiation effects in insulators; Albuquerque, NM, USA (30 May 1983).

Defects in ionic solids involving an electron trapped by an anion vacancy exhibit several unique properties arising from spin-orbit effects in noncentral-force systems, including a complex dependence of the spin-orbit splitting on host-crystal properties. Two such trends evident in new data for F centers are: (a) an approximate inverse power-law dependence of the F-center spin-orbit splitting on the host-crystal lattice parameter and (b) a direct dependence of the splitting on the size of the host-lattice ions. It is demonstrated that the spin-orbit splitting may be described by a semi-empirical formula.

56684 (CPT—83/P.1478) A-c Stark effect in a perfect crystal. Bellissard, J. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jan 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84900040.

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A Bloch electron in an alternating electric field can be submitted to dynamical instabilities. We argue about the type of instabilities and present a rigorous result about stability of scattering states at small coupling. 41 references.

56685 (LA-UR—83-2379) Revision of the statistical mechanics of phonons to include phonon line widths. Overton, W.C. Jr. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 4p. (CONF-8308123—1). NTIS, PC A02/MF A01. Order Number DE83017229.

From 4. international conference on phonon scattering in condensed matter; Stuttgart, F.R. Germany (22 Aug 1983).

Zubarev in 1960 obtained the smeared Bose-Einstein (B-E) function in order to take into account the fact that the eigenenergy associated with a fixed phonon wave vector q and fixed polarization index j is not precisely defined but instead, is smeared by phonon-phonon and phonon-electron interactions. The ratio $\Gamma(qj)/\omega(qj)$ is often quite small, i.e., of the order of 0.01 or less, where Γ is the phonon linewidth and h-bar ω is the eigenenergy. However, in strongly anharmonic crystals Γ/ω may be as large as 0.3 at certain points of the Brillouin zone. In such dramatic cases one would suspect that such phonon linewidths would have some observable effect on the thermodynamic properties. The purpose of this work is to derive the expression for the average free energy per mode for a crystal having large phonon linewidths and to test the properties of the thermodynamic functions derivable from the average free energy per mode. (WHK)

56686 (ORNL—5975) Solid-State Division progress report for period ending March 31, 1983. Green, P.H.; Watson, D.M. (eds.). (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 300p. NTIS, PC A13/MF A01. Order Number DE84000296.

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Progress and activities are reported on: theoretical solid-state physics (surfaces; electronic, vibrational, and magnetic properties; particle-solid interactions; laser annealing), surface and near-surface properties of solids (surface, plasma-material interactions, ion implantation and ion-beam mixing, pulsed-laser and thermal processing), defects in solids (radiation effects, fracture, impurities and defects, semiconductor physics and photovoltaic conversion), transport properties of solids (fast-ion conductors, superconductivity, mass and charge transport in materials), neutron scattering (small-angle scattering, lattice dynamics, magnetic properties, structure and instrumentation), and preparation and characterization of research materials (growth and preparative methods, nuclear waste forms, special materials). (DLC)

56687 (UCRL—76544) Generalized Lindemann law for simple solids. Grover, R. (Lawrence Livermore National Lab., CA (USA)). 27 Feb 1975. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE84000631.

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It is shown that the melting of monatomic solids, when not accompanied by a change in the interatomic forces, is governed approximately by the generalized Lindemann rule of Ross, regardless of the type of interatomic force or the crystal structure of the solid. 4 figures, 3 tables.

56688 (UCRL—89709) Modelling the behavior of materials. Wilkins, M.L. (Lawrence Livermore National Lab., CA (USA)). 12 Aug 1983. Contract W-7405-ENG-48. 14p. (CONF-8309135—4). NTIS, PC A02/MF A01. Order Number DE84000154.

From Computational engineering mechanics conference; Dalian, China (4 Sep 1983).

The problems of greatest interest pertain to metal plasticity. This paper presents the plasticity formulation that has been used for many years at Lawrence Livermore. Both plastic yielding and viscous models are covered. The plasticity formulation offers a numerically simple way of introducing a wide range of material behavior into a calculational program. (DLC)

56689 Plastic flow in close-packed crystals via nonequilibrium molecular dynamics. Ladd, A.J.C.; Hoover, W.G. (Department of Applied Science, University of California at Davis, Davis, California 95616). *Physical Review [Section] B: Condensed Matter;* **28**: No. 4, 1756-1762(15 Aug 1983).

The measurement of plastic-wave profiles in strong shock waves suggests a power-law dependence of the solid-phase shear stress on strain rate. The strain rates in these experiments vary from about 10 kHz to 0.1 GHz. We have carried out molecular-dynamics simulations of steady-state plastic flow in two- and three-dimensional close-packed crystals, using recently developed "nonequilibrium" equations of motion to maintain a constant strain rate and temperature. These calculations appear to be consistent with current experimental data and suggest that the flow of close-packed metals is described by a single physical mechanism over a range of strain rates from 10 kHz to 1 THz.

6561 Superconductivity

REFER ALSO TO CITATION(S) 55957, 55958, 55982, 55998, 56075, 56077, 56203, 56758

56690 (CONF-8308121—1) Aharonov-Bohm effect: influence of the electron's field, and speculations on the possibility of shielding. Peshkin, M. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE83017928.

From International symposium on foundations of quantum mechanics; Kokubunji, Japan (29 Aug 1983).

Aharonov-Bohm (AB) effect is discussed from a viewpoint which stresses the influence of the fields whose source is the scattered particle. Speculations are presented to suggest that AB scattering may be influenced by subtle properties of superconducting surfaces which may shield the particle's fields away from the external magnetic field. Experiments are required to test the reality of such speculations. If such shielding effects can be measured, AB effect may become a sensitive probe to search for unusual surface states which display off diagonal long range order.

56691 Dissipative states in superconductors. Ashby, J.V. Canterbury, England; Canterbury University (1981). 123p. British Lending Library, Boston Spa, Wetherby, West Yorks. No. D37550/81.

Thesis.

Following a brief resume of equilibrium many-body theory, Boltzmann-like equations are derived for a dirty superconductor, possibly containing paramagnetic impurities, driven away from equilibrium by an external field, which take the form of three coupled integro-differential equations for the quasiparticle and phonon population numbers and for the order parameter. These are then expressed explicitly for a B.C.S. superconductor under the constraints of spatial and temporal homogeneity and linearised in the external field. Three methods of solving the resulting integral equations are then discussed, two involving quadratures and one which exploits a variational principle to find approximate representations of the distribution functions. The advantages and limitations of these methods are discussed. Solutions are then found to the equations when the external fields are a) NIS electron tunnelling, b) phonon injection and c) microwave irradiation and these solutions used to calculate the first order changes in the gap and in the nuclear spin relaxation rate as functions of temperature. The solution obtained by variational means is compared with that from a crude quadrature approximation. Using a tailored quadrature the possibility of multiple gap states is investigated numerically.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 56533, 56569, 56633, 56803

56692 (AD-A—127763/1) Quasiresonance of long life. Technical summary report. Meyer, R.E. (Wisconsin Univ., Madison (USA). Mathematics Research Center). Jan 1983. 35p. (MRC-TSR—2466). NTIS, PC A03/MF A01.

Schroedinger's equation for a spherically symmetrical potential with central well surrounded by a barrier is studied in the tunneling range of energies, where it possesses states of very long life and correspondingly large, resonant response. The analysis is based on asymptotics with respect to the long life and large response, related to asymptotics of exponential precision, and leads to simple predictions for life and response.

56693 (AD-A—127996/7) Final report. Report for 1 Mar 78-30 Jun 82. Chudnovsky, D.V.; Chudnovsky, G.V. (Columbia Univ., New York (USA)). 1983. 6p. NTIS, PC A02/MF A01.

Using the method of Backlund transformations the investigators studied in detail classical and quantum two dimensional completely integrable systems, and lattice models equivalent to and approximating these continuous systems were constructed and examined. Among the continuous systems thoroughly examined in this way are the following important models of quantum field theory and statistical mechanics: the matrix (quantum and classical) nonlinear Schrodinger equation, the sine-Gordon equation, the matrix (non-Abelian) Toda lattice, the generalized XXX-and XXZ-quantum models and models of statistical mechanics, and the quantum generalized XYZ-lattice system (whose classical counterpart is the Landau-Lifshitz equation of superconductivity and whose statistical mechanics reductions include the eight-vertex model of Baxter.

56694 (DOE/ET/29196—T3) Program WINDOW user's manual. Theodossiou, G.G. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Electric Power Engineering). Apr 1981. Contract AS01-77ET29196. 62p. NTIS, PC A04/MF A01. Order Number DE84000313.

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The program WINDOW is used for computing the electric field in a region which contains electrodes having various potentials, floating conductors and dielectric materials with different permittivities. It can handle cases of axial or flat symmetry. There exist some programs capable of doing the same thing, but WINDOW has a unique characteristic which can be described as follows: in practice, an engineer will use such a program to see the resulting electric field from an electric configuration which he has designed. His purpose is to make an optimum design of the conductors and the other components of the configuration, thus achieving minimum possible electric stresses in the insulating dielectric material. To obtain this, he might have to change a detail several times to find the optimum design for it. He will have to run the program at least once for each of these different alternatives of the detail and, from the results that he gets, he will see which is the best. This will cost a certain amount of computer money. The fact is that although the electric field will be formed from all components of the configuration, it is only a restricted area where changes are made during each run of the program.

56695 Quasibound-state resonances for a particle in a two-dimensional well. Bayman, B.F.; Mehoke, C.J. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *American Journal of Physics;* **51**: No. 10, 875-883(Oct 1983). Contract AC02-79ER10364.

The problem of a particle moving in a two-dimensional potential well is used to illustrate many of the features of collisions between systems with internal structure. Resonance phenomena are shown to occur when the total energy is close to the energy of a quasibound state, and the width of the resonance is related to the coupling between the quasibound state and the open channels. Explicit calculations are performed for a rectangular potential well.

56696 Model relating ultrasonic scattering measurements through liquid—solid interfaces to unbounded medium scattering amplitudes. Thompson, R.B.; Gray, T.A. (Ames Laboratory, USDOE, Iowa State University, Ames, Iowa 50011). *Journal of the Acoustical Society of America;* **74**: No. 4, 1279-1290(Oct 1983).

The relationship between scattering data obtained from ultrasonic experiments, in which the waves are excited and detected in a finite measurement geometry, and unbounded medium, farfield scattering amplitudes is considered. For a scatterer in a single fluid medium, a Green's function approach is used to develop an approximate, but absolute, relationship between these experimental and theoretical cases. Electromechanical reciprocity relationships are then employed to generalize to a two medium case in which the scatterer is located in an elastic solid which, along with the ultrasonic transducer, is immersed in a fluid medium. The case explicitly considered is one in which the incident waves are quasiplanar over the volume of the flaw and the scattering amplitudes are slowly varying over the range of angles subtended by the receiving transducer. Analytic approximations are developed for the absolute relationship of the received transducer signal to the unbounded medium scattering amplitudes, and formal expressions for the error terms are presented. Preliminary experimental confirmation is reported for the cases of (1) L→L and T→T pulse—echo scattering from oblate spheroidal voids and (2) both pulse—echo and pitch—catch L→L scattering from spherical inclusions. With no adjustable parameters, good agreement for both the phase and absolute amplitude response is observed.

56697 Coagulation equations with gelation. Hendriks, E.M.; Ernst, M.H.; Ziff, R.M. (Institut voor Theoretische Fysica, Fijksuniversiteit Utrecht, The Netherlands). *Journal of Statistical Physics;* **31**: No. 3, 519-622(Jun 1983).

Smoluchowski's equation for rapid coagulation is used to describe the kinetics of gelation, in which the coagulation kernel K/sub i/j models the bonding mechanism. For different classes of kernels we derive criteria for the occurrences of gelation, and obtain critical exponents in the pre- and postgelation stage in terms of the model parameters; we calculate bounds on the time of gelation t/sub c/, and give an exact postgelation solution for the model K/sub i/j = (ij)/sup ω/ (ω>1/2) and K/sub i/j = a/sup i/+j (a>1). For the model K/sub i/j = i/sup ω/+j/sup ω/ (ω<1, without gelation) initial solutions are given. It is argued that the kernel K/sub i/j~ (ij)/sup ω/ with ω≥1-1/d (d is dimensionality) effectively models the sol-gel transformation is polymerizing systems and approximately accounts for the effects of cross-linking and steric hindrance neglected in the classical theory of Flory and Stockmayer (ω = 1). For all ω the exponents, tau = ω+3/2 and σ = ω-1/2, γ = (3/2-ω)/(ω-1/2) and β = 1, characterize the size distribution, at the slightly below the gel point, under the assumption that scaling is valid.

6590 Communication, Education, History, And Philosophy

56698 **(CONF-8308113—1) Unifying physical concepts of reality.** Gilbert, T.L. (Argonne National Lab., IL (USA)). 1 Aug 1983. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01. Order Number DE83017953.

From 2. biennial meeting of the Institute for Ultimate Reality and Meaning; Toronto, Canada (17 Aug 1983).

Physics may be characterized as the science of matter and energy. It anchors the two ends of the frontiers of science: the frontier of the very small and the frontier of the very large. All of the phenomena that we observe and study at the frontiers of science - all external experiences - are manifestations of matter and energy. One may, therefore, use physics to exemplify both the diversity and unity of science. This theme will be developed in two separate examples: first by sketching, very briefly, the historical origins of frontiers of the very small and very large and the converging unity of these two frontiers; and then by describing certain unifying concepts that play a central role in physics and provide a framework for relating developments in different sciences.

56699 **Establishing KEK in Japan and Fermilab in the US: internationalism, nationalism and high energy accelerators.** Hoddeson, L. (Fermi National Accelerator Lab., Batavia, IL (USA); Illinois Univ., Urbana (USA). Dept. of Physics). *Social Studies of Science;* **13**: No. 1, 1-48(Feb 1983).

Comparison of the prehistories of the Fermi National Accelerator Laboratory (Fermilab) in the US, and Ko-bar Enerugii Butsurigaku Kenkyusho (KEK) in Japan, reveals the working of both internationalism and nationalism in high energy physics. International communication and competition helped to create a number of structural parallels from the 1930s to the 1960s; for example, in the postwar period both countries formed their first inter-university government-supported accelerator laboratories; at the turn of the 1960s nuclear physicists in both countries debated about the choice of design for their next higher energy accelerator; and both chose proton synchrotron designs traceable to a common conceptual root. Although Fermilab and KEK progressed through analogous stages in 1960-65, national circumstances caused these developments to diverge in the late 1960s, resulting in a sizeable cut in scale and costly delays in the establishment of KEK.

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 55766

56700 **(INIS-mf—8501) Nuclear fusion: power for the next century.** (UKAEA Headquarters, London). 1980. 9p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703480.

The basis of fusion reactions is outlined, with special reference to deuterium and tritium (from lithium, by neutron reaction) as reactants, and the state of research worldwide is indicated. The problems inherent in fusion reactions are discussed, plasma is defined, and the steps to be taken to generate electricity from controlled nuclear fusion are stated. Methods of plasma heating and plasma confinement are considered, leading to a description of the tokamak plasma confinement system. Devices under construction include the JET (Joint European Torus) Undertaking in the UK. Plans and possibilities for fusion reactors are discussed. (U.K.).

7001 Plasma Research

REFER ALSO TO CITATION(S) 56536

56701 **(AD-A—127951/2) Generation of enhanced-scalelength plasmas and zeeman study of magnetic fields. Memorandum report.** Stamper, J.A.; McLean, E.A.; Obenschain, S.P.; Griem, H.R.; Manka, C.K. (Naval Research Lab., Washington, DC (USA)). 31 Mar 1983. 22p. (NRL-MR—4898). NTIS, PC A02/MF A01.

Using nonuniform laser illumination on flat targets, with moderate laser energies (200J), we have produced enhanced density scalelengths; e.g., in excess of 0.5 mm at 0.1 of critical density. These enhanced scalelengths are of interest in simulating large, high-gain pellets, and investigating the potential impact of longer scalelengths on a variety of convective plasma instabilities. The non-uniform laser irradiation also affects the spontaneous magnetic fields. These fields were measured for the first time using the Zeeman effect. Space-and-time-resolved measurements, for both polarizations, were made of the 2271-2278 A CV triplet emission. A comparison with theory gave fields around 200 kG.

56702 **(CONF-8309103—9) Narrow-band, near-uv, high-repetition-rate laser-induced fluorescence system for use as an edge diagnostic in fusion machines.** Young, C.E.; Gruen, D.M.; Pellin, M.J.; Calaway, W.F. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84000586.

From 9. international vacuum congress and 5. international conference on solid surfaces; Madrid, Spain (26 Sep 1983).

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A laser system for impurity diagnostics in the edge region of fusion devices is described, representing a substantial advance in repetition rate and capacity for velocity distribution measurements. A single mode cw dye laser with scan capability of 30 GHz in 100 msec is amplified by 3 fast flow dye cells, pumped by a high repetition rate excimer laser (60 mJ/pulse at 130 Hz at 308 rm). Average power during the 8 ns pulses of about 0.8 MW for amplified narrowband output at 604 rm, and 80 kW after frequency doubling in KD*P was achieved, with spectral bandwidth in the tenths of GHz regime. The usefulness of such high resolution is demonstrated by a model calculation for Fe velocity spectra involving the presence of thermal and sputtered flux, and spatial averaging. Laboratory velocity spectra are presented for Fe atoms, sputtered in the a^5D_4 ground state.

56703 **(DOE/ER/52062—3) Plasma-surface interactions in magnetic-fusion systems. Annual progress report.** Conn, R.W.; Prinja, A.K. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Jul 1983. Contract AT03-80ER52062. 13p. NTIS, PC A02/MF A01. Order Number DE83015673.

The objective for the first year of the contract was to develop a one dimensional space-time code simulating particle and energy transport in tokamak edge plasmas, incorporating an accurate neutral transport model that properly distinguishes between atomic and molecular hydrogen species. This has been broadly accomplished and a brief summary of the work is presented below. We have also initiated work on modeling the halo plasma of tandem mirrors.

56704 **(DOE/ET/51015—T6) Investigation of RF heating for tandem-mirror experiments. Phaedrus status report, Summer, 1983.** Breun, R.A. (comp.). (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1983. Contract AC02-78ET51015. 13p. NTIS, PC A02/MF A01. Order Number DE84000365.

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This report includes a summary description of experimental results obtained during the period of June, July and August, September 15, 1983 and details of major hardware changes to the Phaedrus experimental facility. Approximately one-third of the time was used to optimize conditions for neutral beam buildup. The remainder of the time was used to advance understanding of the RF heated and fueled tandem mirror experiments.

56705 **(DOE/ET/53036—40) Variational theory of rf-driven currents.** Hitchcock, D.A.; Mahajan, S.M. (Texas Univ., Austin (USA). Fusion Research Center). Jul 1983. Contract AC05-76ET53036. 21p. NTIS, PC A02/MF A01. Order Number DE83016745.

A variational theory for plasma currents driven by Radio Frequency waves is proposed. This theory agrees with earlier theories when the phase velocity of the waves is large but predicts enhanced currents at low phase velocities. The implications of these results are discussed.

56706 **(DOE/ET/53051—59) Plasma physics research (Tokapole II). Technical progress report, October 1, 1981-December 31, 1983.** (Wisconsin Univ., Madison (USA)). 1983. Contract AC02-76ET53051. 87p. NTIS, PC A05/MF A01. Order Number DE84000900.

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Progress during the 27-month period, October 1, 1981 to December 31, 1983 on Tokapole II research is described. Tokapole II is a 4-node poloidal divertor tokamak that can also be run as an octupole. Research during this period has concentrated on studies of discharges with safety factor q less than one and on the identification of the shear Alfven wave resonance. Other topics include measurements of the loop voltage reduction through ECRH start-up, plasma gun refueling, fluctuations and transport, pumped limiter studies, plasma-wall interactions, diagnostic development, polarization of electron cyclotron emission, and poloidal ohmic heating.

56707 **(DOE/ET/53088—97) Hamiltonian formulation of reduced magnetohydrodynamics.** Morrison, P.J.; Hazeltine, R.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jul 1983. Contract FG05-80ET53088. 53p. NTIS, PC A04/MF A01. Order Number DE83016758.

Reduced magnetohydrodynamics (RMHD) has become a principal tool for understanding nonlinear processes, including disruptions, in tokamak plasmas. Although analytical studies of RMHD turbulence have been useful, the model's impressive ability to simulate tokamak fluid behavior has been revealed primarily by numerical solution. The present work describes a new analytical approach, not restricted to turbulent regimes, based on Hamiltonian field theory. It is shown that the nonlinear (ideal) RMHD system, in both its high-beta and low-beta versions, can be expressed in Hanmiltonian form. Thus a Poisson bracket, [,], is constructed such that each RMHD field quantitity, ξ/sub i/, evolves according to ξ/sub i/ = [ξ/sub i/,H], where H is the total field energy. The new formulation makes RMHD accessible to the methodology of Hamiltonian mechanics; it has lead, in particular, to the recognition of new RMHD invariants and even exact, nonlinear RMHD solutions. A canonical version of the Poisson bracket, which requires the introduction of additional fields, leads to a nonlinear variational principle for time-dependent RMHD.

56708 **(DOE/ET/53088—98) Energetic-particle stabilization of ballooning modes in tokamaks.** Rosenbluth, M.N.; Tsai, S.T.; Van Dam, J.W.; Engquist, M.G. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jul 1983. Contract FG05-80ET53088. 13p. NTIS, PC A02/MF A01. Order Number DE83016205.

Introduction of an anisotropic, highly energetic trapped-particle species into a tokamak may allow direct stable access to the high-beta regime of second stability. Under certain conditions, the mode at marginal stability acquires a real frequency close to the precessional drift frequency of the energetic particles, perhaps correlating with recent fishbone observations on PDX.

56709 **(DOE/ET/53088—101) Influence of finite wavelength on the quantum-kicked rotator in the semi-classical regime.** Hanson, J.D.; Ott, E.; Antonsen, T.M. Jr. (Texas Univ., Austin (USA). Inst. for Fusion Studies; Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). Aug 1983. Contract FG05-80ET53088. 30p. NTIS, PC A03/MF A01. Order Number DE84000045.

The quantum-mechanical-kicked rotator, the classical limit of which is described by the standard map, is considered. Particular attention is devoted to a study of the effect of finite wavelength in the wave-mechanical case on the detailed structure of phase space which appears in the classical limit. In the classical case, for large values of the nonlinearity parameter, most of the trajectories are ergodic. However, in addition to these ergodic trajectories, there can be small integrable regions of phase space, known as accelerator modes, which dominate the long-time evolution of the expected value of the particle energy. In this paper it is shown that this behavior is modified in the wave mechanical case for small but finite values of the wavelength (i.e., Planck's constant). A simple model is presented to explain this modification. Based on our results, it is speculated that certain problems in the application of statistical concepts to intrinsically stochastic problems of classical mechanics may, in some cases, be mitigated by wave effects.

56710 **(DOE/ET/53088—103) Nonlinear kinetic theory of a single helicity tearing instability.** Swartz, K.; Hazeltine, R.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Aug 1983. Contract FG05-80ET53088. 25p. NTIS, PC A02/MF A01. Order Number DE84000049.

The evolution of a single helicity tearing mode is analyzed by kinetic theory, including modification of the electron orbits by the islands themselves. Using flux coordinates approrpriate to island geometry, analytic solutions for the time-dependent island width are obtained. These describe evolution from linear growth to nonlinear saturation in the collisionless limit, and transition from such saturation to slow Rutherford-type growth for increasing finite collisionality. Previous work is thus unfied and generalized.

56711 **(DOE/ET/53088—104) Linear relativistic gyrokinetic equation in general magnetically confined plasmas.** Tsai, S.T.; Van Dam, J.W.; Chen, L. (Texas Univ., Austin (USA). Inst. for Fusion Studies; Princeton Univ., NJ (USA). Plasma Physics Lab.; Academia Sinica, Beijing (China)). Aug 1983. Contract AC02-76CH03073;FG05-80ET53088. 16p. NTIS, PC A02/MF A01. Order Number DE84000048.

The gyrokinetic formalism for linear electromagnetic waves of arbitrary frequency in general magnetic-field configurations is extended to include full relativistic effects. The derivation employs the small adiabaticity parameter rho/L_0 where rho is the Larmor radius and L_0 the equilibrium scale length. The effects of the plasma and magnetic field inhomogeneities and finite Larmor-radii effects are also contained.

56712 **(DOE/ET/53088—106) Stochasticity and transport in Hamiltonian systems.** MacKay, R.S.; Meiss, J.D.; Percival, I.C. (Texas Univ., Austin (USA). Inst. for Fusion Studies; Warwick Univ., Coventry (UK); Queen Mary Coll., London (UK)). Aug 1983. Contract FG05-80ET53088. 14p. NTIS, PC A02/MF A01. Order Number DE84000046.

The theory of transport in nonlinear dynamics is developed in terms of leaky barriers which remain when invariant tori are destroyed. We describe the organization of stochastic motion by these barriers and give an explanation of long-time correlations in the stochastic regime.

56713 **(DOE/ET/53088—109) Transport in Hamiltonian systems.** MacKay, R.S.; Meiss, J.D.; Percival, I.C. (Texas Univ., Austin (USA). Inst. for Fusion Studies; Queen Mary Coll., London (UK)). Sep 1983. Contract FG05-80ET53088. 83p. NTIS, PC A05/MF A01. Order Number DE84000047.

We develop a theory of transport in Hamiltonian systems in the context of iteration of area-preserving maps. Invariant closed curves present complete barriers to transport, but in regions without such curves there are still invariant Cantor sets named cantori, which appear to form major obstacles. The flux through the gaps of the cantori is given by Mather's differences in action. This gives useful bounds on transport between regions, and a universal scaling law for one-parameter families when a curve has just broken, which agree well with numerical experiments of Chirikov and explain an apparent disagreement with results of Greene. By dividing the phase space into regions separated by the strongest barriers, and assuming the motion is mixing within them, we derive a global picture of transport, which can be used, for example, to predict confinement times and to explain longtime tails in the decay of correlations.

56714 **(IPP—4/208) Neutral beam power measurements inside the ASDEX torus.** Zengliang, Y.; Staebler, A.; Vollmer, O. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Nov 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751009.

Neutral beam power measurements inside the ASDEX torus are done with a retractable calorimeter which is only radiation cooled. The calorimeter plate made from Molybdenum is subdi-

vided into nine segments whose increase in energy content due to a shot yields the absorbed beam power. Different models for the backward extrapolation of the measured temperature curves are examined for a series of low energy shots with the result that pure radiation cooling is a valid assumption. Furthermore, a temperature correction to the measured power is derived from these experiments. The evaluation of the shots onto this calorimeter is done by a computer program. The application of this program to a few full power shots shows that a neutral power up to 3.2 MW has been injected into the ASDEX vessel by the two injectors with an overall efficiency of up to 40%. Reionization losses due to the ASDEX stray field are less than 10%; they do not show any dependence upon the pulse length for shots up to 200 ms.

56715 **(IPP—6/216) Remarks on stochastic acceleration.** Graeff, P. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751027.

Stochastic acceleration and turbulent diffusion are strong turbulence problems since no expansion parameter exists. Hence the problem of finding rigorous results is of major interest both for checking approximations and for reference models. Since we have found a way of constructing such models in the turbulent diffusion case the question of the extension to stochastic acceleration now arises. The paper offers some possibilities illustrated by the case of 'stochastic free fall' which may be particularly interesting in the context of linear response theory.

56716 **(IPP—6/217) Negative anomalous resistivity - a mechanism of the major disruption in tokamaks.** Biskamp, D.; Welter, H. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jan 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83751019.

A mechanism is given to explain the explosive phase of the major disruption in tokamak-like plasmas. It is based on the phenomenum, that small-scale magnetic turbulence acts on large scale magnetic fields as a negative magnetic diffusivity D. By means of a model equation it is found that negative D causes very rapid growth of tearing modes with a pronounced threshold behavior. Comparison with exact numerical simulations shows remarkably good agreement.

56717 **(IPP—6/218) Lagrangian formulation of a consistent relativistic guiding center theory.** Wimmel, H.K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Feb 1983. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751018.

A new relativistic guiding center mechanics is presented that conserves energy (in time-independent fields) and satisfies a Liouville's theorem. The theory reduces to Littlejohn's theory in the non-relativistic limit and agrees to leading orders in epsilon identical rsub(g)/L with the relativistic theory by Morozov and Solov'ev (which generally lacks a Liouville's theorem). The new theory is developed from an appropriate Lagrangian and is supplemented by a collisionless relativistic kinetic equation for the guiding centers. Moment equations for guiding center density and energy density are also derived.

56718 **(LA—9830-MS) Design of a high-brightness, low-jitter, short-pulse laser for plasma diagnostics.** Lacovara, P. (Los Alamos National Lab., NM (USA)). Aug 1983. Contract W-7405-ENG-36. 11p. NTIS, PC A02/MF A01. Order Number DE84000129.

The High Density Z-Pinch machine at Los Alamos produces a small (~ 100-μm radius), high density (~ 10^{20} cm^{-3}) plasma, on a time scale of 10 to 100 ns. A useful diagnostic for this plasma is the Moire-Schlieren technique, using a fast-pulse nitrogen laser. This report describes a high-brightness, low jitter, low divergence laser system designed for this puprose using an oscillator-amplifier configuration.

56719 **(LA-UR—83-2311) High-density Z-pinch research.** Shlachter, J.S. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 5p. (CONF-8309147—1). NTIS, PC A02/MF A01. Order Number DE83017311.

From 3. international workshop on plasma focus research; Stuttgart, F.R. Germany (12 Sep 1983).

The linear Z pinch is a plasma configuration which in its simplest form requires no auxiliary magnetic field; an axial current carried by the plasma produces an azimuthal confining field and provides ohmic (resistive) or implosion heating. The Lawson criterion (n tau > 10^{20} m^{-3}s) and high temperatures (T > 10 keV) must be simultaneously satisfied in any reactor scheme. Early Z-pinch experiments concentrated on the sub-atmospheric fill pressure regime, with 10^{19} m^{-3} < n < 10^{23} m^{-3} and a corresponding confinement time constraint of 10^{1} s > tau > 10^{-4} s. In addition, these studies involved plasmas formed at the surface of an insulating wall; the plasmas were subsequently pinched inward by the radial j x B force. Following the implosion phase, gross MHD instabilities were invariably observed on a time scale short compared to the required confinement time.

56720 **(LBL—16289) Abstracts submitted for the twenty-fifth annual meeting, Division of Plasma Physics.** (Lawrence Berkeley Lab., CA (USA)). Jul 1983. Contract AC03-76SF00098. 28p. (CONF-831105—Absts.). NTIS, PC A03/MF A01. Order Number DE83015706.

From Meeting of the Plasma Physics Division of the American Physical Society; Los Angeles, CA, USA (7 Nov 1983).

56721 **(ORNL/TM—8738) Preliminary results from microwave scattering on ISX-B: evidence for short coherence times, evidence against poloidal rotation.** Eldridge, O.C.; Wilgen, J.B.; England, A.C. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE84000652.

The density fluctuations on ISX-B with 2 MW of neutral beam heating were measured by microwave scattering at a frequency of 140 GHz. The measurements were made at angles of 70° and 110°, which correspond to fluctuation wavelengths of 1.9 mm and 1.4 mm, respectively. The spectra were measured out to a frequency of 50 MHz by a heterodyne receiver and a spectrum analyzer swept for a time period of 20 ms. Strong scattering was seen over a frequency range of +- 1 MHz, with signals that were 15 to 20 dB above the noise level interpreted as scattering from spatially and temporally coherent density fluctuations in the interior of the plasma. The spectra were very symmetric in frequency with broad wings. There was no evidence for weakly damped plasma waves. There was no observable Doppler shift, which is interpreted as evidence against a poloidal rotation velocity of more than 200 m/s. The maximum width of the spectrum, with 2 MW of neutral beam injection, was 260 kHz at the half-power level. The line shape is interpreted as evidence for a very short coherence time, about 1 μsec, for the widest fluctuation spectra. From a comparison with the data of other scattering experiments, a short coherence length of about 1 to 2 cm is also inferred.

56722 **(ORNL/TM—8804) S3C: EBT Steady-State Shooting code description and user's guide.** Downum, W.B. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 70p. NTIS, PC A04/MF A01. Order Number DE84000617.

The Oak Ridge National Laboratory (ORNL) one-dimensional (1-D) Steady-State Shooting code (S3C) for ELMO Bumpy Torus (EBT) plasmas is described. Benchmark calculations finding the steady-state density and electron and ion temperature profiles for a known neutral density profile and known external energy sources are carried out. Good agreement is obtained with results from the ORNL Radially Resolved Time Dependent 1-D Transport code for an EBT-Q type reactor. The program logic is described, along with the physics models in each code block and the variable names used. Sample input and output files are listed, along with the main code.

56723 **(PPPL—2031) Numerical solution of the resistive magnetohydrodynamic boundary-layer equations.** Glasser, A.H.; Jardin, S.C.; Tesauro, G. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Auburn Univ., AL (USA). Dept. of Physics). Oct 1983. Contract AC02-76CH03073. 73p. NTIS, PC A04/MF A01. Order Number DE84000176.

Three different techniques are presented for numerical solution of the equations governing the boundary layer of resistive

magnetohydrodynamic tearing and interchange instabilities in toroidal geometry. Excellent agreement among these methods and with analytical results provides confidence in the correctness of the results. Solutions obtained in regimes where analytical medthods fail indicate a new scaling for the tearing mode as well as the existence of a new regime of stability.

56724 **(PPPL—2035) Ballooning-mode stability of bean-shaped cross sections for high-β tokamak plasmas.** Chance, M.S.; Jardin, S.C.; Stix, T.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1983. Contract AC02-76CH03073. 16p. NTIS, PC A02/MF A01. Order Number DE84000908.

Indentation of a tokamak plasma on its inner major radius side is shown to be strongly beneficial for achieving high-β stability against ballooning modes. Using a set of reasonable equilibrium profiles, it is found that moderate indentation provides accessibility to the second region of stability. Ohmic equilibrium configurations which exhibit the second stability region have not yet been found.

56725 **(PPPL—2037) Transport analysis of a small stellarator.** Kuo-Petravic, G.; Boozer, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1983. Contract AC02-76CH03073. 32p. NTIS, PC A03/MF A01. Order Number DE84000907.

A Monte Carlo method of evaluating typical particle and energy transport coefficients is given for the case in which the particle drift orbits are a significant fraction of the plasma radius. The method is applied to a preliminary design for a helical axis (heliac) stellarator experiment.

56726 **(UCID—19864) PSOLV: a code for calculating the potentials and densities in MFTF-B.** Colborn, J.A. (Lawrence Livermore National Lab., CA (USA)). 17 Aug 1983. Contract W-7405-ENG-48. 73p. NTIS, PC A04/MF A01. Order Number DE84000821.

Code PSOLV solves for potential and densities at the cardinal points of MFTF-B. The code is equipped to handle both the throttle-coil and the axicell geometries. For the throttle-coil case, the potential at point MXO is input, while the potentials and densities at points MAI, b, and A are calculated. For the axicell case, the code must additionally solve for the potentials and densities at points X and MXO. PSOLV is intended primarily for use as a subroutine in TREQ, a code being developed by Rensink that calculates the densities and potentials at the cardinal points of MFTF-B as a function of time. TREQ is to be used for modeling start-up behavior.

56727 **(UCID—19869) TEBASCO user's guide.** Pearlstein, L.D.; Kaiser, T.B.; LoDestro, L.; Maron, N.; Nevins, W.M.; Willmann, P.A. (Lawrence Livermore National Lab., CA (USA)). 22 Sep 1983. Contract W-7405-ENG-48. 64p. NTIS, PC A04/MF A01. Order Number DE84000973.

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TEBASCO is a Tandem mirror Equilibrium and BAllooning Stability COde. TEBASCO allows you to compute tandem-mirror MHD equilibria and to analyze both the flute-averaged and ballooning-mode stability of these equilibria. This stability analysis is directed toward the computation of marginal stability boundaries. Users of TEBASCO require a binary output file from the EFFI code which describes the vacuum magnetic field. In making this EFFI file the user will have defined a system of units for lengths (e.g., meters) and magnetic field (e.g., Tesla). In TEBASCO, all magnetic field strengths are normalized to the vacuum center-cell midplane value, and times are defined in units of the time for an Alfven wave in this field to transit one EFFI unit of length.

56728 **(UCRL—89345) TMX-U diagnostic system.** Correll, D.L. (Lawrence Livermore National Lab., CA (USA)). 2 Sep 1983. Contract W-7405-ENG-48. 17p. (CONF-8309142—1). NTIS, PC A02/MF A01. Order Number DE83017834.

From 3. conference on hot plasma diagnostics; Dubna, USSR (12 Sep 1983).

Using data from the TMX-U diagnostic system, the production of sloshing ions has already been verified and the formation of electron thermal barriers is presently being investigated on the Tandem Mirror Experiment-Upgrade (TMX-U) at Lawrence Livermore National Laboratory. The TMX-U diagnostics are made up of the earlier TMX complement of diagnostics that determine confinement, microstability, and low-frequency stability, plus diagnostic instrumentation that measures electron parameters associated with mirror-confined electrons. This paper describes the three subsystems within the TMX-U diagnostic system: (1) the diagnostic facility (shot leader console, data cable system, and diagnostic timing system); (2) the individual diagnostic instruments that measure plasma and machine parameters; and (3) the data-acquisition and -analysis computer.

56729 **Theory of mode conversion and wave damping near the ion cyclotron frequency.** Colestock, P.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Kashuba, R.J. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). *Nuclear Fusion;* **23**: No. 6, 763-780(Jun 1983).

Using a variational technique, a set of coupled model equations for the mode conversion process near the ion cyclotron frequency is derived. The system is truncated to first order in Larmor radius but includes the effects of explicit gradients and a poloidal field. From the equations a conservation rule is extracted which ensures conservation of total energy and provides an explicit expression for the wave damping in differential form. The equations are integrated numerically for the standard cases of fast waves incident from either the low- or high-field sides of the mode conversion layer. The scaling of the damping processes is discussed and implications for current RF heating experiments on the Princeton Large Torus are drawn.

56730 **Radio-frequency wave trajectories for current drive in tokamak reactors.** Wong, K.L.; Ono, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **23**: No. 6, 805-815(Jun 1983).

Detailed ray-tracing calculations are carried out for three modes of waveguide-launched radio-frequency waves (lower hybrid wave, fast wave and ion Bernstein wave) for tokamak reactor parameters, to evaluate their applicability for steady-state current drive. The merits and demerits of each mode are discussed.

56731 **Optical imaging of edge turbulence in the Caltech tokamak.** Zweben, S.J.; McChesney, J.; Gould, R.W. (Department of Applied Physics, California Inst. of Tech., Pasadena (USA)). *Nuclear Fusion;* **23**: No. 6, 825-830(Jun 1983).

Letter-to-the-editor.

A linear photodiode array is used to image visible-light emission from the edge plasma of the Caltech tokamak. The patterns of light fluctuation show small-scale broadband structure similar to that previously measured for plasma edge density turbulence. A high correlation is found between these light fluctuations and the fluctuations measured by a nearby Langmuir probe.

56732 **New trends in unconventional approaches to magnetic fusion. Report on the symposium, Stockholm, Sweden, 16-18 June 1982.** Post, R.F. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Fusion;* **23**: No. 6, 835-844(Jun 1983).

This document reports on the symposium on "new trends in unconventional approaches to magnetic fusion" held in Stockholm, 16 - 18 June 1982. Following items were discussed: Increasing magnetic efficiency (e.g. FRC and spheromak); higher power density (e.g. RFP); simplification of geometry (e.g. mirror-based systems); ultra-intense magnetic fields (e.g. high-density Z-pinch).

56733 **SEURAT: A Monte-Carlo algorithm for calculating neutral gas transport in non-circular axisymmetric toroidal plasmas.** Heifetz, D.B.; Post, D.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Computer Physics Communications;* **29**: No. 3, 287-299(May 1983).

Calculation of mass and energy transport by neutral particles in toroidally symmetric plasmas with non-circular poloidal cross sections.

56734 **Confinement heating and stability in the ELMO Bumpy Torus (EBT).** Uckan, N.A. (Oak Ridge National Lab., TN (USA)). *Plasma Physics;* **25**: No. 2, 129-160(Feb 1983).

High power ECH(utilizing a 28-GHz gyrotron at power levels up to 200 kW, cw) and fast-wave ICH (in the frequency range 15-30 MHz at power levels up to 20 kW, cw) experiments on EBT-Scale (EBT-S) have yielded Tsub(e) approximately equal to 1.1 keV, n approximately equal to 1-2 x 10^{18} m^{-3}, and tausub(E) approximately equal to 6 ms. The ring and core loss rates scale as predicted by the neoclassical theory, and the plasma parameters have the predicted values for the densities, temperatures, and confinement times reachable in this small plasma radius (10 cm) device at low field (1.0 T). In addition, the following observations were made: (1) the stable operating window is larger at high power levels, (2) a substantial increase in energetic ion tails (Tsub(i)>100 eV) and a doubling of the ring electron stored energy (beta) were seen at the highest ICH power levels, and (3) a significant increase in core density and stabilization of hot electron modes was possible with gas puffing. The effects of heating methods, stability, neoclassical transport, nonadiabaticity, and ring power balance on the performance of an EBT reactor are discussed. Core plasma beta values in the range 10-15% have been estimated, but the reliability and importance of these estimates remain to be determined by future experiments and form a key objective for the EBT Proof-of-Principle (EBT-P) device. Potential variations on the basic EBT configuration that were expected to enhance reactor performance are discussed.

56735 **Auxiliary heating results from PDX and PLT.** Davis, S.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Plasma Physics;* **25**: No. 2, 189-206(Feb 1983).

Auxiliary heating experiments are continuing on both PLT and PDX. PLT has increased the available ICRF power delivered to the plasma to 3 MW for the 42 MHz system and to 1.6 MW for the 25 MHz system. Deuteron and electron heating are observed in the minority ^{3}He(Tsub(d)approximately equal to 2.8 keV, Tsub(e) approximately equal to 2.2 keV) and H(Tsub(d) approximately equal to 2 keV, Tsub(e) approximately equal to 2.2 keV) heating regimes. In addition, ion heating is observed in the second harmonic regime (Tsub(eff)=2/3 <Esub(h)>=3.3 keV).

56736 **Shear Alfven continuous spectrum of axisymmetric toroidal equilibria in the large aspect ratio limit.** Kieras, C.E.; Tataronis, J.A. (Wisconsin Univ., Madison (USA)). *Journal of Plasma Physics;* **28**: 395-414(Dec 1982).

Analytic forms for the MHD continuous spectra in axisymmetric tokamak equilibria are derived using an expansion scheme in powers of the small inverse aspect ratio. Resulting formulae for the shear Alfven continuum have been evaluated for the shear Alfven wave heating experiment on the Tokapole II device at the University of Wisconsin-Madison. Mode coupling, induced by toroidicity or non-circularity, is shown to occur, in first order, on and near rational surfaces for particular poloidal and toroidal mode numbers. The coupling is shown to produce gaps in the spectrum, analogous to the gaps which appear in the energy spectrum of a single electron in a periodic potential lattice.

56737 **Generalized expressions for momentum and energy losses of charged particle beams in non-Maxwellian multi-species plasmas and spherical symmetry.** Cuperman, S.; Weiss, I. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). *Journal of Plasma Physics;* **28**: 445-457(Dec 1982).

Generalized expressions for the rates of change of the momentum, energy and thermal anisotropy of fast, charged particle beams interacting with non-Maxwellian multi-species plasmas are derived. The results hold for the case of spherically symmetric systems and, therefore, are relevant for inertial confinement fusion schemes driven by fast charged particle beams and for various astro-physical situations. The calculations are based on the Fokker-Planck formalism. The effects connected with the departures from the Maxwellian distribution functions are expressed in terms of their fifth moments, zetasub(l) is equivalent to $\int$(vsub(r)-<vsub(r)>)^{4}fsub(l)dV, which reflect the role of the non-Maxwellian tails. The familiar stopping power expression holding for Maxwellian targets is recovered as a particular case.

56738 **Nonlinear stability of doublets against axisymmetric resistive MHD modes.** Jensen, T.H.; McClain, F.W. (General Atomic Co., San Diego, CA (USA)). *Journal of Plasma Physics;* **28**: 495-501(Dec 1982).

The development of the axisymmetric droplet-ellipse mode of doublets has been calculated including second-order terms of the perturbation. The results of this calculation provide a qualitative explanation of observations made in doublet experiments which could not be explained from a linear instability theory, namely that (i) development toward droplet or ellipse is not random; (ii) deterioration of the equilibrium is faster than predictions based on linear theory. Furthermore the nonlinear formalism shows that an effective nonlinear stabilization of the liner instability cannot be expected although it may have a very small growth rate.

56739 **Lower-hybrid instability in current-carrying plasmas.** Willett, J.E.; Mehdian, H. (Missouri Univ., Columbia (USA). Dept. of Physics). *Journal of Plasma Physics;* **28**: 527-537(Dec 1982).

The stability of lower-hybrid waves in a collisional, fully ionized plasma carrying a field-aligned current is investigated. From the two-fluid equations in the cold-plasma approximation, a generalized dispersion relation and formulae for the real frequency ωsub(R) and growth rate ωsub(I) are derived. The results of a numerical study are presented showing the dependence of ωsub(R) and ωsub(I) on the angle between the direction of propagation and the magnetic field, the ratio of the electron drift velocity to the parallel phase velocity, and other plasma parameters. Lower-hybrid instability with electron drift velocity small compared with the parallel phase velocity is predicted.

56740 **Stationary plasma double layers sustained by differential vacuum pumping.** Jones, R. (Plasma Physics Research Lab., Colonia, New Jersey (USA)). *Journal of the Indian Institute of Science;* **63**: No. 2, 1-5(Feb 1981).

8 refs.

The differential vacuum pumping of a plasma column introduces a strong axial dependence into the electron-gas ionization rate leading to axially varying plasma density and potential. Such a configuration may be useful as a gridless ion extraction system, a unidirectional ion source discharge, or to enhance the gas efficiency of an ion source.

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REFER ALSO TO CITATION(S) 55496, 55496, 55965, 55966, 55967, 55968, 55969, 55970, 55971, 55972, 55973, 55974, 55989, 55990, 55991, 55993, 56078

56741 **(BNL—51692) Design and operation of a laminar-flow electrostatic-quadrupole-focused acceleration column.** Maschke, A.W. (Brookhaven National Lab., Upton, NY (USA)). 20 Jun 1983. Contract AC02-76CH00016. 4p. NTIS, PC A02/MF A01. Order Number DE84000820.

This report deals with the design principles involved in the design of a laminar-flow electrostatic-quadrupole-focused acceleration column. In particular, attention will be paid to making the parameters suitable for incorporation into a DC MEQALAC design.

56742 **(CONF-830942—14) Recent developments in neutron dosimetry and radiation damage calculations for fusion-materials studies.** Greenwood, L.R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84000598.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

This paper is intended as an overview of activities designed to characterize neutron irradiation facilities in terms of neutron flux and energy spectrum and to use these data to calculate atomic displacements, gas production, and transmutation during fusion materials irradiations. A new computerized data file, called DOSFILE, has recently been developed to record dosimetry and damage data from a wide variety of materials test facilities. At present data are

included from 20 different irradiations at fast and mixed-spectrum reactors, T(d,n) 14 MeV neutron sources, Be(d,n) broad-spectrum sources, and spallation neutron sources. Each file entry includes activation data, adjusted neutron flux and spectral data, and calculated atomic displacements and gas production. Such data will be used by materials experimenters to determine the exposure of their samples during specific irradiations. This data base will play an important role in correlating property changes between different facilities and, eventually, in predicting materials performance in fusion reactors. All known uncertainties and covariances are listed for each data record and explicit references are given to nuclear decay data and cross sections.

56743 **(CONF-830942—24) TRIO-01 experiment: in-situ tritium-recovery results.** Clemmer, R.G.; Finn, P.A.; Billone, M.C.; Misra, B.; Arons, R.M.; Poeppel, R.B.; Dyer, F.F.; Dudley, I.T.; Bate, L.C.; Clemmer, E.D. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). Aug 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84000610.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The TRIO-01 experiment is a test of in-situ tritium recovery from γ-$LiAlO_2$ with test conditions chosen to simulate those anticipated in fusion power reactors. A status report is presented which describes qualitatively the results observed during the irradiation phase of the experiment. Both the rate of tritium release and the chemical forms of tritium were measured using a helium sweep gas which flowed past the breeder material to a gas analysis system.

56744 **(CONF-830942—25) Fabrication of high rate chromium getter sources for fusion applications.** Gabbard, W.A.; Simpkins, J.E.; Mioduszewski, P.; Edmonds, P.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE84000342.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Design and fabrication techniques are described for the manufacture of large-capacity chromium getter sources, analogous to the commercially available titanium getter source known as Ti-Ball, manufactured by Varian Associates.

56745 **(CONF-830942—29) Mass transfer behavior of a modified austenitic stainless steel in lithium.** Tortorelli, P.F.; DeVan, J.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84000338.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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An austenitic stainless steel that was developed to resist neutron damage was exposed to lithium in the high-temperature part of a thermal convection loop for 6700 h. Specimens of this Prime Candidate Alloy (PCA) composed of 65.0 Fe-15.9 Ni-13.0 Cr-1.9 Mo-1.9 Mn-1.7 Si-0.5 Ti-0.05 C (wt %) were exposed at 600 and 570°C in both solution annealed and cold worked forms. The dissolution process was found to be similar to other austenitic alloys in flowing lithium: weight losses of PCA eventually became linearly proportional to exposure time with the specimen surfaces exhibiting porous layers depleted in nickel and chromium. However, the measured weight losses and dissolution rates of these PCA specimens were higher than those of type 316 stainless steel exposed under similar conditions and can be attributed to the higher nickel concentration of the former alloy. The effect of cold work on dissolution rates was less definitive, particularly at 570°C. At longer exposure times, the annealed PCA specimen exposed at 600°C suffered greater dissolution than the cold worked material, while no effect of prior deformation was observed by analysis of the respective surfaces.

56746 **(CONF-830971—4) Manufacturing development of the Westinghouse Nb_3Sn coil for the Large Coil Test Program.** Young, J.L.; Vota, T.L.; Singh, S.K. (Westinghouse Electric Corp., East Pittsburgh, PA (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84000717.

From 8. international conference on magnet technology and exhibition; Grenoble, France (5 Sep 1983).

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The Westinghouse Nb_3Sn Magnet for the Oak Ridge National Laboratory Large Coil Program (LCP) is currently well into the manufacturing phase. This paper identifies the manufacturing processes and development tasks for his unique, advanced coil.

56747 **(DOE/DP/40030—T2) Laser fusion research. Quarterly progress report, October-December 1980.** (KMS Fusion, Inc., Ann Arbor, MI (USA)). 20 Dec 1980. Contract AC08-78DP40030. 27p. NTIS, PC A03/MF A01. Order Number DE84000489.

Long scale length gas jet target experiments were conducted this quarter using 1.05 μm and 0.53 μm laser light. The laser intensity was sufficiently high to observe saturation of the back-reflected laser light at both wavelengths. The plasma was thoroughly characterized using holographic interferometry and x-ray spectroscopy to obtain density and temperature variation. Spectroscopic measurements (with various gas mixtures) made by LLNL scientists collaborating on these experiments have been supportive of previous measurements made by KMSF. Preliminary results indicate electron densities of $10^{21}/cm^3$ and temperature of 700 eV.

56748 **(DOE/DP/40139—1) Generation and focusing of pulsed intense ion beams. Technical progress report, 20 August 1981-30 September 1982.** Hammer, D.A.; Kusse, B.R.; Sudan, R.N. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). Jul 1983. Contract AS08-81DP40139. 11p. NTIS, PC A02/MF A01. Order Number DE84001397.

The progress on this contract is described in two parts. The first deals with the technical operation of the LION accelerator which is the exact equivalent to one line of PBFA-I. The second part is concerned with the experimental results on the ion diode mounted at the front end of the LION accelerator.

56749 **(DOE/DP/40156—1) Investigation of soft x-ray reflective coatings. Final report, February 1-August 30, 1983.** Flint, B.K.; Hagenlocher, A.K. (Acton Research Corp., MA (USA)). 1983. Contract AC08-81DP40156. 76p. NTIS, PC A05/MF A01. Order Number DE84000510.

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Current fusion experiments require efficient soft x-ray reflective coatings on the optics of diagnostic instrumentation, in order to record the images and spectra of x-ray emissions from laser fusion targets in the 30 eV to 1 keV energy range. The advent of the routine availability of selectively reflecting soft x-ray coatings, on a series of mirrors optimized for wavelengths of interest, would make possible fast multi-channel target diagnostics. Sorting the orders of light dispersed by conventional grating and crystal monochromators would also be possible; in fact such coatings could be used alone as low-resolution x-ray analyzers.

56750 **(EGG-M—18183) Tests on irradiated magnet-insulator materials.** Schmunk, R.E.; Miller, L.G.; Becker, H. (EG and G Idaho, Inc., Idaho Falls (USA); Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 1983. Contract AC07-76ID01570. 5p. (CONF-830942—30). NTIS, PC A02/MF A01. Order Number DE84000806.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Fusion-reactor coils, located in areas where they will be only partially shielded, must be fabricated from materials which are as resistant to radiation as possible. They will probably incorporate resistive conductors with either water or cryogenic cooling. Inorganic insulators have been recommended for these situations, but the possibility exists that some organic insulators may be usuable as well. Results were previously reported for irradiation and testing of three glass reinforced epoxies: G-7, G-10, and G-11. Thin disks of these materials, nominally 0.5 mm thick by 11.1 mm diameter, were tested in compressive fatigue, a configuration and loading which represents reasonably well the magnet environment. In that work G-10 was shown to withstand repeated loading to moderately high stress levels without failure, and the material survived better at liquid nitrogen temperature than at room temperature.

56751 **(IPP—1/211) Supplement to 'ASDEX Upgrade, definition of a tokamak experiment with a reactor-compatible poloidal divertor' (IPP-report 1/197, March 1982).** (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Nov 1982. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751011.

ASDEX Upgrade Design Team and Tokamak Theory Group.

Since March 1982 the better understanding of the divertor physics, both by theory and experiments, and the development of the ASDEX Upgrade concept have considerably improved and simplified the ASDEX Upgrade design. Single null poloidal divertor configurations were calculated, which can well compete with elongated limiter configurations in reduced poloidal field effort. The role of recycling and its limitation set by the available energy flux, observed experimentally and explained by a plasma boundary flow model, led to a refined formulation of the line density requirements. Finally, a discussion of the attainable temperature and densities allowed clearly to distinguish between ASDEX and ASDEX Upgrade and pointed out the dominant role of the plasma current. The ASDEX Upgrade basic data are summarized as presented to the EURATOM advisory board.

56752 **(IPP—2/260) Evaluation of the energy required for constructing and operating a fusion power plant.** Buende, R. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Sep 1982. 32p. (CONF-820948—8). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751008.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

The energy required for constructing and operating a tokamak fusion power plant is appraised with respect to the energy output during the lifetime of the plant. A harvesting factor is deduced as a relevant figure of energetic merit and is used for a comparison between fusion, fission, and coal-fired power plants. Because fusion power plants involve considerable uncertainties the comparison is supplemented by a sensitivity analysis. In comparison with Light Water Reactor plants fusion power plants appear to be rather favourable in this respect. The energy required for providing the fuel is relatively low for fusion plants, thus overcompensating the considerable higher amount of energy necessary for constructing the fusion power plant.

56753 **(IPP—2/262) Burn stabilization via feedback ripple regulation in an ignited tokamak.** Borrass, K.; Soell, M. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Oct 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751010.

Active burn stabilization of an ignited tokamak by feedback ripple regulation is considered on the basis of recent investigations on ripple-induced transport with insufficient temperature dependence for passive stabilization. Ripple variation is achieved by asymmetric coil currents in the even and odd TF coils. Reference is made to an INTOR-like device. The study comprises a linearized stability analysis based on a O-D plasma description, TF coil calculations relating the current asymmetry to the ripple size and an analysis of the coil/power supply circuitry. Critical performance parameters are obtained in terms of the size of an initial perturbation of the plasma from thermal equilibrium. The performance parameters discussed are the voltages that have to be applied to the TF coils, the powers and energies transferred from external sources and the losses within the TF coils that are associated with the varying field. All critical parameters, subject to technical limitations, are very much on the safe side. The power and energy that have to be transferred from external sources to the TF system can be kept negligibly small by a proper circuit design. No net power is required for the ripple variation. The enhancement of the stationary power requirements by the coil losses is insignificant.

56754 **(IPP—III/80) Characteristics of divertor plasma in neutral beam heated ASDEX discharges.** Shimomura, Y.; Keilhacker, M.; Lackner, K.; Murmann, H.; Siller, G. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1982. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83751020.

Characteristics of divertor plasma with neutral beam injection (Psub(NI)) <= 2.5 MW) are studied. Major objectives are obtaining an ideal divertor plasma with low temperature and high density as well as clarifying plasma characteristics in the divertor. The major conclusions are as follows: A strong inhomogeneity along magnetic field lines of density, nsub(e), and temperature, Tsub(e), in the scrape-off layer, e.g. Tsub(eb) approx.= 100 eV and nsub(eb) approx.= 10^{13} cm^{-3} at the torus mid-plane in the main chamber and Tsub(ed) approx.= 10 eV and nsub(ed) approx.= 10^{14} cm^{-3} near the neutralizer plate in the divertor chamber. Plasma parameters near the neutralizer plate such as Tsub(ed) and nsub(ed) are strong functions of recycling conditions in the divertor, e.g. gas source, pumping speed and width of divertor throat, as well as of discharge conditions in the main chamber, e.g. density, heating power and confinement.

56755 **(Juel—1816) Measurement of transient magnetic fields and eddy current time constants of TEXTOR.** Eulenberg, H.; Thyssen, H.; Steffen, B. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentrallabor fuer Elektronik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralinstitut fuer Angewandte Mathematik). Nov 1982. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83751015.

This report describes measuring devices, data processing and numerical methods to measure and analyse transient magnetic fields in the Juelich TEXTOR tokamak. Six Hall-plates were mounted onto a small car running on wooden rails which was automatically positioned into 29 different places by a PDP 11/40 computer. In three equi distant points lying on the same corcross section of the toroidal vacuum vessel of TEXTOR the vertical and radial component of the magnetic induction were measured by a Hall-plate. The results of this measurements were stored on-line in the PDP 11/40 and prepared for subsequent further analysis. In off-line calculations the amplitudes and decay rates of the exponentially decaying part of the magnetic field were determined. This part is caused by eddy currents in the steel structure of TEXTOR. The report closes with a sample of the measuring results.

56756 **(KFK—3465) Basis and concepts for the electromagnetic acceleration of pellets for injection into inertial confinement fusion reactor chambers.** Kreutz, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Feb 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83751017.

The possibility of the electromagnetic acceleration of pellets for injection into inertial confinement fusion reactor chambers is investigated. The acceleration by a high gradient magnetic field is discussed for different types of driving bodies (non-ferromagnetic cylinder, ferromagnetic cylinder, superconducting coil) of the pellet carrier. Two accelerator concepts are described. Alternatively, pellet acceleration by a railgun is investigated. In all cases a 1 g-projectile can be accelerated to a reference velocity of 200 m/s over a distance of the order of 1 m which corresponds to an acceleration time of the order of 10 ms. For each of the methods investigated reference parameter lists are given as a basis of orientation for the technical design of an electromagnetic pellet accelerator.

56757 **(KFK—3466) Comparison of pneumatic and electromagnetic pellet injection for inertial confinement fusion reactors.** Kreutz, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Feb 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751016.

The work on pellet injection within the framework of the HIBALL reactor study for inertial confinement fusion is summarized. The results on the physical feasibility of a pneumatic and a magnetic pellet acceleration and proposals for adequate pellet carriers are given, reference parameter values are presented. Both investigated methods are compared and evaluated with respect to the technical status of the components of a pellet injection system to give a concluding recommendation.

56758 (KFK—3494) Results of research and development work in 1982 of the Institut fuer Technische Physik. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). Feb 1983. 50p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83751013.

The works in the Institute for Technical Physics (ITP) concentrated in 1982 upon the application of high current superconductivity in the fields of energy engineering and fusion. Moreover, the magnet technology for use in other fields of research and technology is advanced. Fundamental investigations on cryogenics and superconductors as well as studies go along with the technical research program. The magnetic fields of stationary and quasi-stationary fusion reactors with magnetic confinement have to be produced by superconductivity. The aim of the magnet developments in the KfK is therefore to make available the technology of superconductivity for large-scale experiments in plasma physics and the later fusion reactors, which is performed in co-operation with industry as part of the European fusion program.

56759 (KMSF-U—1280) Quarterly progress report, July-September 1982. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1982. Contract AC08-82DP40152. 31p. NTIS, PC A03/MF A01. Order Number DE83017527.

Our ability to characterize fuel shells was greatly improved this quarter by the installation of the Eikonix Image Acquisition System. Linking this system to the VAX 11/750 computer permits real-time imaging of radiographic plates. Analysis of the thermal transport experimental campaign continued. We found that the mass-ablation rate was significantly higher for spherical targets than for planar targets. The ablation rate was also greater for 0.53 μm light used in similar experiments performed earlier. The analysis of the emission of light at 3/2 omega$_0$ and of the two-lobe feature detected in the thermal transport experiments has been examined and found to be consistent with the theory for two-plasmon decay. Further analysis of stimulated Brillouin scattering has shown the quenching of the process through a secondary process involving the decay of the primary ion acoustic wave into two secondary ion waves.

56760 (LMF—102, pp 71-73) **Aerosols from fusion energy systems.** Hoover, M.D.; Lee, J. Dec 1982. NTIS, PC A25/MF A01.

In Inhalation Toxicology Research Institute. Annual report, October 1, 1981-September 30, 1982.

A metal chelate vaporization technique was used in a tube furnace to generate ultrafine branched-chain aggregate iron aerosols. A plasma torch was used to aerosolize high purity iron and type 304 stainless steel under conditions more similar to a plasma quench in a fusion system or to plasma torch segmentation of used fusion blanket materials or structure. All aerosols were branched-chain aggregates with primary particle geometric diameters smaller than 0.05 μm. Aerosol output ranged up to 5 mg/minute for the metal chelate vaporization and up to 2000 mg/minute for the plasa torch vaporization. Both the plasma torch and the metal chelate vaporization techniques appear to be suitable for generating aerosols typical of those likely to be found in fusion reactor systems, but use of the metal chelate has major advantages for future studies.

56761 (NRL-MR—5089) Vortex shedding and laser ablation. Emery, M.H.; Gardner, J.H.; Boris, J.P.; Cooper, A.L. (Naval Research Lab., Washington, DC (USA)). 22 Sep 1983. Contract AI01-77DP40042. 14p. NTIS, PC A02/MF A01. Order Number DE84000301.

Through a critical examination of the vortex dynamics of laser ablatively accelerated targets we are able to explain the inhibited linear Rayleigh-Taylor growth rates, clarify the role of the Kelvin-Helmholtz roll-up, explain the short wavelength cutoff, explain and theoretically reproduce dynamically stabilized growth rates and predict magnetic field structures throughout the overdense region which lead to a physically motivated model of thermal flux inhibition.

56762 (ORNL/TM—8803) Summary of ISX-B limiters and internal components. Langley, R.A. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE84000650.

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This report describes the limiters and internal components of the Impurity Study Experiment (ISX-B) as of May 1983. The positions of the fixed limiters and internal components are noted; for movable limiters the limits of position are given. In addition, the function, shape, size, and material of each component are given, along with the name of the scientist responsible for that component.

56763 (PNL-SA—11454) Pulsed-flux effects on radiation damage. Simonen, E.P.; Ghoniem, N.M.; Packan, N.H. (Pacific Northwest Lab., Richland, WA (USA); California Univ., Los Angeles (USA); Oak Ridge National Lab., TN (USA)). Sep 1983. Contract AC06-76RL01830. 12p. (CONF-830942—6). NTIS, PC A02/MF A01. Order Number DE84000602.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

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Pulsed irradiation fluxes can cause alteration in the development of irradiation microstructures when compared to steady irradiation microstructures. Theoretical analysis of irradiation damage development and examination of pulsed ion irradiation microstructures have indicated conditions for expected pulsing effects on fusion reactor materials. In pure metals, high instantaneous damage rates and pulse annealing periods comparable to defect relaxation times can cause significant pulsing effects. In addition, irradiation modified phases in alloys are altered by pulsed irradiation compared to steady irradiation.

56764 (PPPL—2008) Control of neutron albedo in toroidal fusion reactors. Micklich, B.J.; Jassby, D.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1983. Contract AC02-76CH03073. 30p. NTIS, PC A03/MF A01. Order Number DE84000521.

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The MCNP and ANISN codes have been used to obtain basic neutron albedo data for materials of interest for fusion applications. Simple physical models are presented which explain albedo dependence on pre- and post-reflection variables. The angular distribution of reflected neutrons. The energy spectra of reflected neutrons are presented, and it is shown that substantial variations in the total neutron current at the outboard wall of a torus can be effected by changing materials behind the inboard wall. Analyses show that a maximum of four isolated incident-current environments may be established simultaneously on the outboard side of a torus. With suitable inboard reflectors, global tritium breeding ratios significantly larger than unity can be produced in limited-coverage breeding blankets when the effects of outboard penetrations are included.

56765 (PPPL—2032) PBX: the Princeton beta experiment. Bol, K.; Chance, M.; Dewar, R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1983. Contract AC02-76CH03073. 127p. NTIS, PC A07/MF A01. Order Number DE83017363.

A rearrangement of the divertor coils in PDX will enable a test in 1984 of the MHD stability properties of deeply indented bean-shaped plasmas. The goal is a beta of 10%. Indentation is expected to counter the deterioration of MHD stability against pressure driven modes that is occasioned by the larger aspect ratios typical of anticipated reactor oriented devices. Indeed, as shown by M. Chance et al., indentation may offer direct access to the second region of stability for ballooning modes, and numerical analyses with PEST show the internal kink to be stabilized completely with even relatively modest indentation. The internal kink is implicated in the loss of beam ions in PDX. In this report the theoretical basis for the forthcoming experiment, and the design considerations underlying the modification from PDX to PBX, are described in detail. Additional theoretical material, including an analysis of particle orbits in an indented tokamak plasma, is appended.

56766 **(PPPL—2036) Heliac parameter study.** Monticello, D.A.; Dewar, R.L.; Furth, H.P.; Reiman, A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1983. Contract AC02-76CH03073. 26p. NTIS, PC A03/MF A01. Order Number DE84000906.

Helical axis stellarators (heliacs) with zero net current are found to possess very good stability properties. Helically symmetric or straight heliacs with bean-shaped cross sections have a first region of stability that reaches to (β) of 30% or more. Those with circular cross sections have second region of stability to Mercier modes. In addition we report on the stability properties of these plasma configurations as functions of pressure profile, helical aspect ratio, and helical period length.

56767 **(PPPL—2041) Initial-temperature profiles on the PDX inner toroidal limiter.** Ulrickson, M.; Kugel, H.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1983. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A01. Order Number DE83017812.

The temperature profiles resulting from plasma operation on the PDX vertical, large area, inner toroidal limiter have been measured during both ohmic and neutral-beam-heated discharges using a scanning infrared camera. An asymmetric double-peaked temperature profile is seen after neutral-beam-heated discharges. Disruptions in ohmically heated discharges are found to be preceded by a single-peaked deposition and succeeded by an initially symmetric double-peaked deposition. The results were compared with the Schmidt model for scrape-off at a toroidal limiter and it was found that the measured double-peaked temperature profiles yielded scrape-off lengths consistent with previous measurements.

56768 **(SAND—83-0541C) Hybrid ion diode theory and computations.** Quintenz, J.P.; Mendel, C.W. Jr.; Miller, P.A.; Crow, J.T.; Mix, L.P.; Rosenthal, S.E. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830911—17). NTIS, PC A02/MF A01. Order Number DE84000102.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

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Intense ion beams for inertial-confinement fusion research are produced by diodes in which electron current is inhibited by strong magnetic fields. The insulating magnetic field in these diodes can be produced by the particle currents themselves or by an external field coil. The Hybrid ion diode incorporates a series field coil and a grooved epoxy filled anode to produce the pulsed ion beam. Both polar and equatorial versions of this diode concept have been tested. The design of these diodes will be discussed, including the description of various computer codes used in this process. The confirmation of various aspects of the theory for Hybrid diode operation will be discussed. A method for optimizing the diode focus will be described. A ray trace code has been written to investigate the focal properties of beams from these diodes and results will be given. Some particle-in-cell computations for specific diode designs will also be presented and compared with experimentally measured quantities.

56769 **(SAND—83-1375C) Numerical simulations of high-power diodes.** Quintenz, J.P.; Poukey, J.W.; Seidel, D.B.; Mendel, C.W. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-830911—14). NTIS, PC A02/MF A01. Order Number DE84000116.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

The numerical simulation of intense electron and ion beam diodes is an important tool in the understanding of these devices. Many different computer codes have been written to investigate various aspects of diode design, performance, and scaling. Several engineering codes will be described. Two types of two-dimensional particle-in-cell (PIC) diode simulation codes have been used at Sandia National Laboratories in high-power diode research, an electrostatic-magnetostatic code and a fully electromagnetic code. In a steady-state simulation, the voltage across the diode anode and cathode electrodes is held fixed at some value (peak voltage for example) and the simulation is continued until the gross diode features such as total current or potential distribution undergo acceptably small fluctuations about a steady-state. Some examples of steady-state and electromagnetic simulations will be presented. The particular example of the Hybrid ion diode will be discussed.

56770 **(SAND—83-1773C) Grad-B drift transport of high current electron beams.** Lee, J.R.; Backstrom, R.C.; Halbleib, J.A.; Wright, T.P. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830911—15). NTIS, PC A02/MF A01. Order Number DE84000115.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

Grad-B transport, bunching and focusing of relativistic electron beams has been proposed as a method of increasing the power delivered to an ICF target by an order of magnitude. Recent experiments have demonstrated the efficient transport of high current electron beams over 1.0 m distances in the 1/r azimuthal magnetic field of a current-carrying wire. The electron drift velocity was measured as a function of wire current and found to be in good agreement with theory. Measurements of x-ray production in a tantalum target were used as a diagnostic tool to study transport efficiency. A theoretical model of the experiment was developed to calculate bremsstrahlung production in the target, assuming 100 percent transport efficiency. This model predicted radial x-ray dose profiles in the experimental converter assembly which were in good agreement with the measurements.

56771 **(UCID—19878) Model approach for simulating the thermodynamic behavior of the MFTF cryogenic cooling systems - a status report.** Sutton, S.B.; Stein, W.; Reitter, T.A.; Hindmarsh, A.C. (Lawrence Livermore National Lab., CA (USA)). 31 Aug 1983. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01. Order Number DE84000186.

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A numerical model for calculating the thermodynamic behavior of the MFTF-B cryogenic cooling system is described. Nine component types are discussed with governing equations given. The algorithm for solving the coupled set of algebraic and ordinary differential equations is described. The model and its application to the MFTF-B cryogenic cooling system has not been possible due to lack of funding.

56772 **(UCID—19898) Failure analysis of Ti - 15% Ta getter wire used for sublimation in the vacuum chambers of the Tandem Mirror Experiment.** Kershaw, R.P.; Gross, R.J.; Dalder, E.N.C. (Lawrence Livermore National Lab., CA (USA)). 19 Aug 1983. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01. Order Number DE84001221.

The Tandem Mirror Experiment uses Ti-15% Ta getter wire for sublimation in the vacuum chambers in which the magnets are located. These wires have failed prematurely in service, resulting in increased costs and downtime. We have used optical metallography to show that the reason for these failures was the cycling of the material through the alpha-beta transition temperature, causing alpha-titanium precipitation at the grain boundaries, depression of the melting temperatures of those boundaries, and the subsequent melting of those boundaries in areas where the wires had achieved localized higher temperatures.

56773 **(UCRL—53391) Calculation of ion charge-state distribution in ECR ion sources.** West, H.I. Jr. (Lawrence Livermore National Lab., CA (USA)). 8 Dec 1982. Contract W-7405-ENG-48. 65p. NTIS, PC A04/MF A01. Order Number DE84000517.

Starting with the pioneering efforts of Y. Yongen (Louvain-la-Neuve, Belgium) a code has been developed to calculate the equilibrium ion charge-state distribution for electron-cyclotron resonance source (ECR) ion sources. Production of ions is caused by the impact ionization of the charge gas from ECR-heated electrons of a few keV. Loss of an ion of a given charge state is from charge exchange and radiative recombination. Ultimately, the ion flows out of the minimum-B containment region. The ion confinement times are calculated using an ion-trap-potential model which is based upon modeling calculations done at Lawrence Livermore National

Laboratory (LLNL) for the Tandem Mirror Machine. Using this model requires the self-consistent determination of the trap potential and thermal electron density in the plasma. Code inputs are gas natural density, hot-electron temperature and density, ion temperature, cold-electron temperature, mirror ratio, physical dimensions, and atomic-physics data. Other than that there are no adjustable parameters. Results of comparison of calculations with the limited available data are reasonable.

56774 **(UCRL—87708) Pulse-power circuit diagnostics for the Nova laser.** Christie, D.J.; Dallum, G.E.; Gritton, D.G.; Merritt, B.T.; Whitham, K.; Berkbigler, L.W. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). 7 Jun 1982. Contract W-7405-ENG-48. 4p. (CONF-820626—15). NTIS, PC A02/MF A01. Order Number DE83018183.

From 15. power modulator symposium; Baltimore, MD, USA (14 Jun 1982).

The Nova laser will have a large pulse power system for driving laser amplifiers, incorporating approximately 1600 flashlamp circuits. An automated system has been designed for diagnosing the condition of these flashlamp circuits. It records digitized circuit current waveforms and detects current excursions above a given threshold. In addition, it is able to fire flashlamps at a low energy to ascertain the health of the system. Data from this system can be ploted for inspection by the operator, analyzed by the computer system and archived for future reference.

56775 **(UCRL—88668) Infant-mortality testing of high-energy-density capacitors used on Nova.** Merritt, B.T.; Whitham, K. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 5p. (CONF-830621—44). NTIS, PC A02/MF A01. Order Number DE83018027.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

Nova is a solid-state large laser for inertial-confinement fusion research. Its flashlamps are driven by a 60-MJ capacitor bank. Part of this bank is being built with high-energy-density capacitors, 52-μF, 22 kV, 12.5 kJ. A total of 2645 of these capacitors have been purchased from two manufacturers. Each capacitor was infant-mortality tested. The first test consisted of a high-potential test, bushing-to-case, since these capacitors have dual bushings. Then the capacitors were discharged 500 times with circuit conditions approximating the capacitors normal flashlamp load. Failure of either of these tests or if the capacitor was leaking was cause for rejection.

56776 **(UCRL—88670) Programmable controller with overcurrent latch for constant primary peak current in capacitor-charging FET switcher for Nova.** Mihalka, A.M. (Lawrence Livermore National Lab., CA (USA)). 6 Jun 1983. Contract W-7405-ENG-48. 4p. (CONF-830621—42). NTIS, PC A02/MF A01. Order Number DE83018184.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

New switching power supplies were designed for the 10 mm laser amplifiers in the Nova Master Oscillator Room. The flashlamp supply must be repratable. Therefore, we designed a constant current, linearly charging power supply. Since it is a capacitor, the load varies throughout the charge cycle. At first the load is great, and di/dt of load current is at a maximum. As the capacitor charges the initial conditions for each cycle change, the power supply in effect sees a smaller capacitance, and di/dt decreases. We need a way of gradually increasing the on-time of the current pulses so that the transistors in the power bridge are turned off when they reach their maximum peak current. The normal current sense response of the control chip is not fast enough to be useful for our application. The deadtime, or the time that all the bridge transistors are turned off, is fixed so that as the pulse width varies so does the period. We end up with a constant peak current, switching power supply whose frequency varies from 50 khz to 20 khz. Finally, an overcurrent latch protects the transistors from bridge or transformer faults. The circuit is described and results are shown.

56777 **(UCRL—88682) Inertial effects in laser-driven ablation.** Harrach, R.J.; Szeoke, A.; Howard, W.M. (Lawrence Livermore National Lab., CA (USA)). 15 Jul 1983. Contract W-7405-ENG-48. 7p. (CONF-830719—44). NTIS, PC A02/MF A01. Order Number DE84000071.

From American Physical Society meeting on shock waves in condensed media; Santa Fe, NM, USA (18 Jul 1983).

The gasdynamic partial differential equations (PDE's) governing the motion of an ablatively accelerated target (rocket) contain an inertial force term that arises from acceleration of the reference frame in which the PDE's are written. We give a simple, intuitive description of this effect, and estimate its magnitude and parametric dependences by means of approximate analytical formulas inferred from our computer hydrocode calculations. Often this inertial term is negligible, but for problems in the areas of laser fusion and laser equation of state studies we find that it can substantially reduce the attainable hydrodynamic efficiency of acceleration and implosion.

56778 **(UCRL—88987) Construction and operational experience of the Tandem Mirror Experiment-Upgrade (TMX-U).** Chargin, A.K.; Calderon, M.O.; Moore, T.L. (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1983. Contract W-7405-ENG-48. 15p. (CONF-8309103—8). NTIS, PC A02/MF A01. Order Number DE83018181.

From 9. international vacuum congress and 5. international conference on solid surfaces; Madrid, Spain (26 Sep 1983).

The Tandem Mirror Experiment-Upgrade (TMX-U) incorporates two new features at Lawrence Livermore National Laboratory (LLNL) tandem mirror program, thermal barriers in the end plugs and injection of the neutral beams at several oblique angles. The thermal barriers isolate the electrons in the end plugs from those in the central cell, making it possible to heat them independently with microwaves. In addition, this innovation produces a large potential gradient in the end plugs with lower magnetic fields and lower neutral-beam energies than would be possible in a conventional tandem mirror device. The TMX-U is also designed to test neutral-beam-injection angles as an experimental parameter. We use angles other than 90° to produce a plasma with improved microstability.

56779 **(UCRL—89277) Evolution of the mirror machine.** Damm, C.C. (Lawrence Livermore National Lab., CA (USA)). 18 Aug 1983. Contract W-7405-ENG-48. 29p. (CONF-831171—1). NTIS, PC A03/MF A01. Order Number DE83016942.

From American Vacuum Society meeting; Boston, MA, USA (1 Nov 1983).

The history of the magnetic-mirror approach to a fusion reactor is primarily the history of our understanding and control of several crucial physics issues, coupled with progress in the technology of heating and confining a reacting plasma. The basic requirement of an MHD-stable plasma equilibrium was achieved following the early introduction of minimum-B multipolar magnetic fields. In refined form, the same magnetic-well principle carries over to our present experiments and to reactor designs. The higher frequency microinstabilities, arising from the non-Maxwellian particle distributions inherent in mirror machines, have gradually come under control as theoretical prescriptions for distribution functions have been applied in the experiments. Even with stability, the classical plasma leakage through the mirrors posed a serious question for reactor viability until the principle of electrostatic axial stoppering was applied in the tandem mirror configuration. Experiments to test this principle successfully demonstrated the substantial improvement in confinement predicted. Concurrent with advances in mirror plasma physics, development of both high-power neutral beam injectors and high-speed vacuum pumping techniques has played a crucial role in ongoing experiments. Together with superconducting magnets, cryogenic pumping, and high-power radiofrequency heating, these technologies have evolved to a level that extrapolates readily to meet the requirements of a tandem mirror fusion reactor.

56780 **(UCRL—89328) Nova laser assurance-management system.** Levy, A.J. (Lawrence Livermore National Lab., CA (USA)). 18 Jul 1983. Contract W-7405-ENG-48. 23p. (CONF-8309145—1). NTIS, PC A02/MF A01. Order Number DE83018188.

From 10. American Society for Quality Control annual energy division conference; San Diego, CA, USA (18 Sep 1983). Portions are illegible in microfiche products.

In a well managed project, Quality Assurance is an integral part of the management activities performed on a daily basis. Management assures successful performance within budget and on schedule by using all the good business, scientific, engineering, quality assurance, and safety practices available. Quality assurance and safety practices employed on Nova are put in perspective by integrating them into the overall function of good project management. The Nova assurance management system was developed using the quality assurance (QA) approach first implemented at LLNL in early 1978. The LLNL QA program is described as an introduction to the Nova assurance management system. The Nova system is described pictorially through the Nova configuration, subsystems and major components, interjecting the QA techniques which are being pragmatically used to assure the successful completion of the project.

56781 **(UCRL—89834) Rail-accelerator development for ultra-high-pressure research.** Hawke, R.S.; Nellis, W.J.; Rego, J.; Susoeff, A.R.; Newman, G.H. (Lawrence Livermore National Lab., CA (USA)). 14 Sep 1983. Contract W-7405-ENG-48. 6p. (CONF-8310164—1). NTIS, PC A02/MF A01. Order Number DE84000470.

From 2. symposium on electromagnetic launch technology; Boston, MA, USA (11 Oct 1983).

During the last year, we have begun detailed development of a railgun launcher and power source. We are developing a launcher with a gas injector. The injector accelerates the projectile to more than 1 km/s reducing the dwell time of the plasma arc and the erosion of the rails. The injected projectile, with a fuse, also serves as the main switch in the power supply circuit. Current pulse shaping is used to control the applied stress to the projectile and launcher. Results of experiments with the new system will be reported and compared to computer simulations.

56782 **Lithium doping of candidate fusion reactor alloys to simulate simultaneous helium and damage production.** Megusar, J.; Harling, O.K.; Grant, N.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering; Massachusetts Inst. of Tech., Cambridge (USA). Nuclear Reactor Lab.). *Journal of Nuclear Materials;* **115**: No. 2/3, 192-196(Apr 1983).

Lithium and boron doping techniques are possibilities for simulating simultaneous helium production and displacement damage in bulk specimens of non-nickel bearing materials in fast fission reactors. Rapid solidification processing and powder metallurgy salt decomposition were investigated for the preparation of lithium doped alloys. For convenience, austenitic stainless steel was doped rather than non-nickel bearing alloys for which this technique is ultimately designed. Neutron autoradiography verified a uniform distribution of lithium in the alloy. Although the same approach can be used to dope alloys uniformly with a stable boron compound, thus reducing the problem of grain boundary segregation and coarsening, the use of lithium doping should be an advantage because this dopant produces only helium and hydrogen when irradiated in a fast fission reactor. These elements are also produced in materials in the CTR environment.

56783 **Use of mercury to regenerate liquid-alloy tritium getters.** Carstens, D.H.W.; David, W.R. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials;* **115**: No. 2/3, 203-205(Apr 1983).

Because of the health hazards associated with tritium, it is essential to maintain low tritium concentration in the process streams of future fusion reactors. Thus, it is important to use highly efficient getter systems. Our previous work has shown that liquid alloys are, indeed, efficient getters of tritium and the results of the experiments reported here further support their use in such an application. By considering the initial D/La ratio in these experiments and taking into account the errors, we calculate that the gas was removed to a D/La value in the getter of 0.03 or below.

56784 **Influence of nonmetallic elements on the compatability of structural materials with liquid alkali metals.** Natesan, K. (Argonne National Lab., IL (USA). Materials Science and Technology Div.). *Journal of Nuclear Materials;* **115**: No. 2/3, 251-262(Apr 1983).

With 42 refs.

Liquid alkali metals such as sodium and lithium are being considered as heat-transfer media in liquid-metal cooled fast-breeder reactors and as a tritium-breeding blanket in fusion reactors. In these applications, the interaction(s) of nonmetallic impurity elements in the liquid alkali metals, such as oxygen, carbon, nitrogen, and hydrogen, with structural materials is of concern. This paper discussed purification methods for control of nonmetallic impurity elements in liquid sodium and lithium, and the limitations of the various methods. Interactions between structural metals and nonmetallic elements in liquid alkali metals are analyzed in terms of equilibrium distribution coefficients and the concentrations of nonmetallic elements in liquid alkali metals that are sufficient for compound formation with the structural metals. A number of experimental observations that describe various types of interactions are presented, and major differences in material behavior in liquid sodium and lithium environments are identified.

56785 **Retention and recycling of plasma edge hydrogen isotopes in C and TiC.** Brice, D.K.; Doyle, B.L.; Wampler, W.R.; Picraux, S.T. (Sandia National Labs., Albuquerque, NM (USA)); Haggmark, L.G. (Sandia National Labs., Livermore, CA (USA)). *Journal of Nuclear Materials;* **114**: No. 2/3, 277-291(Feb 1983).

Also published as report SAND--82-0821, Jun 1982.

The retention, release, and isotopic exchange of hydrogen, deuterium, and tritium incident on room temperature C and TiC with Maxwellian velocity and isotropic angular distributions have been calculated using the Local Mixing Model. These calculations are based on the hydrogen saturation concentration, range distributions and isotopic exchange behavior, all of which have been verified experimentally by monoenergetic implants. Particle fluences (10^{16} to 10^{20}/cm^2) and characteristic Maxwellian energies (50 eV to 3200 eV) were chosen in the range of interest for tokamak plasma edge conditions. The results of these calculations are used to estimate tritium inventory buildup and to predict tritium changeout rates by isotopic exchange in tokamaks and other fusion devices. Tritium inventories in the TiC components (which comprise > or approx.20% of the TFTR first-wall surface) are anticipated to remain at reasonable levels in TFTR, and isotopic exchange is shown to be a feasible method to reduce these tritium inventories.

56786 **Cross field injection and trapping of a continuous plasma beam in a magnetic mirror.** Wickham, M.; Robertson, S. (California Univ., Irvine (USA). Dept. of Physics). *Journal of Plasma Physics;* **25**: No. 1, 103-110(Jan 1983).

A beam of potassium plasma of 10^{12}cm^{-3} density from a continuous magnetoplasma-dynamic arc source has been propagated into a magnetic mirror device in a direction transverse to the magnetic field. A self induced polarization and E x B drift of the beam was observed. The plasma filled the magnetic mirror to a density of 10^{12}cm^{-3} when insulating end plugs were used. The density was slightly reduced if the mirror ratio was reduced to unity and was reduced to 10^{11}cm^{-3} if the end plugs were made conducting thus shorting the electric field. The temperature of the trapped plasma corresponded to approximately two thirds of the energy in the initial motion of the beam. These results are discussed qualitatively in terms of the polarization drift model of Schmidt. The possible application of this injection technique to tandem mirrors is discussed briefly.

56787 **Irradiation creep in the fusion reactor first wall.** Coghlan, W.A.; Mansur, L.K. (Oak Ridge National Lab., TN (USA)). *Res Mechanica;* **7**: No. 2, 85-124(1983).

Understanding the characteristics of irradiation creep in the first wall of a fusion reactor will allow evaluations of the engineering consequences and design considerations dependent on this form

of dimensional instability. There are currently no data on irradiation creep under fusion reactor conditions. However, a number of significant differences are expected between the irradiation environment of a fusion reactor and that of a fission reactor. These differences are expected to affect the characteristics of irradiation creep in the fusion reactor. Special conditions of importance are identified as the (1) large number of defects produced per primary knock-on atom (PKA), (2) high helium production rate, (3) cyclic operation, (4) unique stress histories, and (5) low-temperature operation. Existing experimental data from fission reactors are analysed to shed light on irradiation creep under fusion conditions. Theoretical considerations are used to deduce additional characteristics of irradiation creep in the fusion reactor for which no experimental data are available.

56788 **Neutronics - tritium breeding.** Santoro, R.T. (Oak Ridge National Lab., TN (USA)). *Res Mechanica;* 8: No. 1, 1-27(1983).

The neutronics of tritium breeding are reviewed. The ramifications of breeding are delineated with respect to overall blanket design. A brief commentary on the one-dimensional discrete ordinates method for estimating tritium production is presented. Some examples of the tritium breeding capability of prototypic blanket designs are summarised along with examples of the influence on calculated tritium breeding ratios of cross section uncertainties.

56789 **Fusion materials development in the US.** Conn, R.W. (Univ. of California, Los Angeles). *American Society for Testing and Materials, Special Technical Publication;* No. 782, 1159-1178(1982). (CONF-820628—).

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

Materials research is recognized as a key to the development of an economic and reliable fusion reactor. The environment in which materials must perform in a magnetic fusion reactor is established and general criteria for selecting structural and special purpose materials are summarized. On this basis, the US program in materials development for fusion is described. Key program elements include the development of alloys for use as structural materials, the study of fundamental processes central to radiation damage analysis, the development of components capable of handling high heat and particle fluxes that are incident on components like limiters, divertor target plates, neutral beam heat dumps, and other in-vessel components in fusion reactors. The relationship of the materials program to the rest of the national fusion program is discussed.

99 GENERAL AND MISCELLANEOUS

9901 Management

56790 **(INIS-mf—8502) Using radioactivity.** (UKAEA Headquarters, London). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703529.

The leaflet discusses the following: radioactivity; radioisotopes; uses of ionising radiations; radioactivity from (a) naturally occurring radioactive elements, and (b) artificially produced radioisotopes; uses of radioactivity in medicine, (a) clinical diagnostic, (b) therapeutic (c) sterilization of medical equipment and materials; environmental uses as tracers; industrial applications, e.g. tracers and radiography; ensuring safety. (U.K.).

56791 **(NUREG/CR—3447-Vol.1) Research prioritization using the Analytic Hierarchy Process: basic methods. Volume 1.** Vesely, W.E.; Shafaghi, A.; Gary, I. Jr.; Rasmuson, D.M. (Battelle Columbus Labs., OH (USA)). Aug 1983. 89p. (BMI—2106-Vol.1). NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE83910798.

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This report describes a systematic approach for prioritizing research needs and research programs. The approach is formally called the Analytic Hierarchy Process which was developed by T.L. Saaty and is described in several of his texts referenced in the report. The Analytic Hierarchy Process, or AHP for short, has been applied to a wide variety of prioritization problems and has a good record of success as documented in Saaty's texts. The report develops specific guidelines for constructing the hierarchy and for prioritizing the research programs. Specific examples are given to illustrate the steps in the AHP. As part of the work, a computer code has been developed and the use of the code is described. The code allows the prioritizations to be done in a codified and efficient manner; sensitivity and parametric studies can also be straightforwardly performed to gain a better understanding of the prioritization results. Finally, as an important part of the work, an approach is developed which utilizes probabilistic risk analyses (PRAs) to systematically identify and prioritize research needs and research programs. When utilized in an AHP framework, the PRA's which have been performed to date provide a powerful information source for focusing research on those areas most impacting risk and risk uncertainty.

56792 **DOE enforcement: RIF's and budget reductions (Part 2, Volume 1). Hearings before the Subcommittee on Oversight and Investigations and the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Seventh Congress, First Session on the proposed dismantling of the Department of Energy, and the Economic Regulatory Administration's compliance program, July 28 and September 25, 1981.** Washington, DC; Government Printing Office (1983). 811p.

Two days of hearings examined the problem of rapid attrition among DOE personnel, threatened reduction in force (RIF), and threatened impoundment of funds in order to comply with the administration's goal of dismantling DOE. The 20 witnesses represented the General Accounting Offices, the National Treasury Employees Union, and several departments of DOE. Additional material submitted by DOE and 10 appendices with relevant correspondence and documents follow the testimony. (DCK)

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 55953, 56252, 56285, 56291, 56570

56793 **(ANL—83-70) Algorithms for automated diagnosis of faults in physical plant.** Gabriel, J.R. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 40p. NTIS, PC A03/MF A01. Order Number DE84000192.

This report presents a diagnostic automation that can be used to investigate classes of systems without feedback loops. This report shows the input needed for the automation, the algorithm used, and the PROLOG program for the simulation.

56794 **(BDX—613-2982) Investigation in the application of computer-aided process-planning techniques for Mechanical Engineering at Bendix Kansas City. Final report.** Brooks, S.L. (Bendix Corp., Kansas City, MO (USA)). Aug 1983. Contract AC04-76DP00613. 25p. NTIS, PC A02/MF A01. Order Number DE84000302.

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Computer-aided process planning (CAPP) was found to have good potential application for Mechanical Engineering at Bendix. A working knowledge of CAPP techniques and current state-of-the-art was gained. Potential applications that used a variant system were defined. An implementation plan was established to develop and evaluate CAPP for Mechanical Engineering.

56795 **(BNL—33617) Enabling CTS handshaking on the Intel 8251A USART in asychronous polled mode.** Bernstein, H.J. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 18p. NTIS, PC A02/MF A01. Order Number DE83018277.

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The Intel 8251A Universal Synchronous/Asynchronous Receiver/Transmitter (USART) provides microprocessors with a programmable communications interface to serial lines. When used with external devices which can accept data at all times at the selected baud rate, the 8251A can fully utilize the available band-

width by internal double-buffering of the transmitted data. When used with devices such as fast serial printers, which require a ready-resume handshake via a Clear-To-Send (CTS) lead, this double buffering can cause loss of characters. In many, if not most, systems a software solution is available. The 8251A brings the Data-Set-Ready (DSR) lead into its status word, as bit 7, and provides a Transmit-Buffer-Empty (TxEmpty) status bit, bit 3. If CTS is bridged to DSR and no transmission is done until DSR, TxEmpty, and Transmit Ready (TxRDY) are all set to one, then the remote handshake will be honored. In some systems, however, the software is not available for alteration, and a hardware solution is desirable. This note shows how to modify the 8251A support circuitry, so that the TxRDY bit reported to the CPU carries all the necessary information for a CTS handshake.

56796 **(CONF-830492—2) Short introduction to office applications of markup language.** Mason, J.D. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE83011400.

From Association Francaise de Normalisation (AFNOR) meeting; Paris, France (12 Apr 1983).

56797 **(DOE/ER/01195—477) FASTBUS Segment Driver microcode description.** Lesny, D. (Illinois Univ., Urbana (USA). Dept. of Physics). Jun 1983. Contract AC02-76ER01195. 96p. (COO—1195-477). NTIS, PC A05/MF A01. Order Number DE83017972.

The FASTBUS Segment Driver, hereafter referred to as the FSD, is a list-driven, microcoded interface between the UNIBUS of a PDP-11 system and the FASTBUS. The list structure used by the FSD allows the programmer on the PDP-11 to program a sequence of data transfers to take place without the aid or intervention of the PDP-11. This allows the FASTBUS to be driven at FSD rates, independent of the PDP-11 processor. Due to the difference in speed between the FASTBUS and UNIBUS, the major goal of the FSD was to provide an interface which could transfer data on FASTBUS without significantly reducing the bandwidth in a multi-master system. This was accomplished by bursting data on the FASTBUS through a 256 word fast buffer internal to the FSD. Data can be transferred at near FASTBUS rates through this memory and only moved on the UNIBUS when the FSD is not master of FASTBUS. This allows other masters in the same system to transfer their data while the FSD is moving data on the slower UNIBUS.

56798 **(IKE—4-107) Programming guidelines and their automatic testing.** Kleinbach, K.; Lang, U.; Ruehle, R. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Jan 1982. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83751007.

Within the development of a maintenance system for the integrated programming system RSYST, programming standards were compiled and a program modul was developed for automatic testing of a large part of this standard. The programming standards are related to structured programming, readability and documentation, uniqueness, safety and portability of programs, that are written in FORTRAN IV. The program REGELT reports the lines of the program, in which there is a noncompliance to the rules. Furthermore a statistical evaluation is given on the non-compliances at the end of every subroutine. This allows the programmer some control during program development, as well as a check of other programs with respect to the installation, test and maintenance expense.

56799 **(LA-UR—83-2493) Variational method for adaptive grid generation.** Brackbill, J.U. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 11p. (CONF-8309135—3). NTIS, PC A02/MF A01. Order Number DE83017312.

From Computational engineering mechanics conference; Dalian, China (4 Sep 1983).

A variational method for generating adaptive meshes is described. Functionals measuring smoothness, skewness, orientation, and the Jacobian are minimized to generate a mapping from a rectilinear domain in natural coordinate to an arbitrary domain in physical coordinates. From the mapping, a mesh is easily constructed. In using the method to adaptively zone computational problems, as few as one third the number of mesh points are required in each coordinate direction compared with a uniformly zoned mesh.

56800 **(SAND—77-8239) Adaptive procedure for estimating parameters for the nonsymmetric Tchebychev iteration.** Manteuffel, T.A. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1977. Contract W-7405-ENG-48. 46p. NTIS, PC A03/MF A01. Order Number DE84000633.

An iteration based upon the Tchebychev polynomials in the complex plane can be used to solve large sparse nonsymmetric linear systems whose eigenvalues lie in the right half plane. The iteration depends upon two parameters which can be chosen from knowledge of the convex hull of the spectrum of the linear operator. This paper deals with a procedure based upon the power method for dynamically estimating the convex hull of the spectrum. The stability of the procedure is discussed in terms of the field of values of the operator. Results show the adaptive procedure to be an effective method of determining parameters. The Tchebychev iteration compares favorably with several competing iterative methods.

56801 **(SAND—83-0637) PLT: a multipurpose plotting package.** Selleck, C.B.; Sears, M.P. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1983. Contract AC04-76DP00789. 116p. NTIS, PC A06/MF A01. Order Number DE83018261.

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PLT is a device independent plotting package developed under the ARIES project in Department 1530. It is built on top of the Sandia Virtual Device Interface (VDI) and therefore supports many different devices. The capabilities of the package include basic plotting primitives, clipping subroutines, color, element plotting routines, software and hardware text, two dimensional graph plotting, mapping subroutines and routines to set various PLT parameters. PLT is coded in RATFOR, a FORTRAN preprocessor and is currently supported on VAX/VMS.

56802 **(SAND—83-1731) XREF: an RSX-11 utility for constructing an inter-module cross-reference map.** Thompson, M. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1983. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01. Order Number DE84000969.

This paper discusses a brute force approach to generating an Inter-Module cross-reference listing by using the DEC RSX-11 Indirect Command File Processor to manipulate the input to, and output from a 3rd party vendor's cross assembler/linker. Specifically, the BSO (Boston Systems Office) Z80 cross-assembler and linker package is used to demonstrate the technique.

56803 **(UCID—19873) T-HEMP3D user manual.** Turner, D. (Lawrence Livermore National Lab., CA (USA)). Aug 1983. Contract W-7405-ENG-48. 203p. NTIS, PC A10/MF A01 . Order Number DE84000526.

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The T-HEMP3D (Transportable HEMP3D) computer program is a derivative of the STEALTH three-dimensional thermodynamics code developed by Science Applications, Inc., under the direction of Ron Hofmann. STEALTH, in turn, is based entirely on the original HEMP3D code written at Lawrence Livermore National Laboratory. The primary advantage STEALTH has over its predecessors is that it was designed using modern structured design techniques, with rigorous programming standards enforced. This yields two benefits. First, the code is easily changeable; this is a necessity for a physics code used for research. The second benefit is that the code is easily transportable between different types of computers. The STEALTH program was transferred to LLNL under a cooperative development agreement. Changes were made primarily in three areas: material specification, coordinate generation, and the addition of sliding surface boundary conditions. The code was renamed T-HEMP3D to avoid confusion with other versions of STEALTH. This document summarizes the input to T-HEMP3D, as used at LLNL. It does not describe the physics simulated by the

program, nor the numerical techniques employed. Furthermore, it does not describe the separate job steps of coordinate generation and post-processing, including graphical display of results. (WHK)

56804 **(UCID—19889) Communicating between the IBM Personal Computer and the Wang word-processing system.** Downey, R.M. (Lawrence Livermore National Lab., CA (USA)). 7 Sep 1983. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01. Order Number DE83017987.

This manual outlines the steps for transferring documents to a Wang word processor from an IBM Personal Computer (PC) and for retrieving stored documents from the Wang. We first look at hardware and software needed to connect the two systems before detailing the steps to take in transferring a document.

56805 **(UCRL—89385) Efficient large-scale finite-element computations in a CRAY environment.** Goudreau, G.L.; Bailey, R.A.; Hallquist, J.O.; Murray, R.C.; Sackett, S.J. (Lawrence Livermore National Lab., CA (USA)). Jun 1983. Contract W-7405-ENG-48. 15p. (CONF-831111—5). NTIS, PC A02/MF A01. Order Number DE83014946.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

The Lawrence Livermore National Laboratory engineering computational experience on the CRAY-1 is highlighted in the context of our large general purpose solid and structural mechanics codes. DYNA2D and DYNA3D are explicit large deformation inelastic Lagrangian codes with one point elements and hourglass control. NIKE2D and NIKE3D are implicit codes of comparable continuum formulation but use two point constant pressure elements and an optimized linear equation solver. NIKE3D has a finite rotation plastic resultant shell element. The new general purpose linear elastic structures code GEMINI is also illustrated for large static and eigenvalue analysis. 19 references.

56806 **(UCRL—89666) Block adaptive filtering for computational complexity savings: a tutorial.** Clark, G.A. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1983. Contract W-7405-ENG-48. 8p. (CONF-8310165—1). NTIS MF A01. Order Number DE84000166.

From National electronics conference; Chicago, IL, USA (23 Oct 1983).

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The purpose of this paper is to describe block adaptive filters in terms of their properties and their usefulness, without excessive mathematical detail. The topics discussed include brief introduction to the LMS and BLMS filters, a discussion of the generic nature of the block approach and computational complexity considerations.

56807 **(UCRL—89706) Overview of digital-image processing.** Twogood, R.E.; Sherwood, R.J. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 7p. (CONF-8308127—1). NTIS, PC A02/MF A01. Order Number DE84000156.

From 26. Midwest symposium on circuits and systems; Puebla, Mexico (15 Aug 1983).

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This paper presents an overview of the field of digital-image processing. Particular attention is devoted to the fundamental concepts involved in image processing, including image digitization and typical goals. Some of the most important image processing algorithms are also discussed, with emphasis on techniques that are applicable across a broad range of applications.

56808 **What can we learn from homoclinic orbits in chaotic dynamics?.** Gaspard, P.; Nicolis, G. (Faculte des Sciences de l'Universite Libre de Bruxelles, Campus Plaine, CP 226, Bd du Triomphe, B1050 Bruxelles, Belgium). *Journal of Statistical Physics;* **31**: No. 3, 499-518(Jun 1983). Contract AS05-81ER10947.

State diagrams of two model systems involving three variables are constructed. The parameter dependence of different forms of complex nonperiodic behavior, and particularly of homoclinic orbits, is analyzed. It is shown that the onset of homoclinicity is reflected by deep changes in the qualitative behavior of the system.

9903 Information Handling

REFER ALSO TO CITATION(S) 56271

56809 **(CONF-8104221—1) Common communication format for bibliographic data exchange.** Gove, N.B.; Hughes, T.E.; Matiushin, G.D.; Turtanov, N.V. (Oak Ridge National Lab., TN (USA); Library of Congress, Washington, DC (USA); USSR State Public Library for Science and Technology, Moscow; Gosudarstvennyj Komitet Soveta Ministrov SSSR po Nauke i Tekhnike, Moscow). 1981. Contract W-7405-ENG-26. 15p. NTIS MF A01. Order Number DE83017248.

From Meeting with Soviet experts on common communication format for information exchange; Washington, DC, USA (14 Apr 1981).

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Development of a format for use in the exchange of machine-readable bibliographic information between the USA and the USSR is discussed. ISO standards will be used, where relevant, for carrier format and character codes. Extensions to UNIMARC have been proposed for content designators to accommodate the needs of abstracting and indexing services. A common listing format, including a transliteration scheme, has been developed for test and check purposes.

56810 **(UCRL—53439) TIS: an Intelligent Gateway Computer for information and modeling networks. Overview.** Hampel, V.E.; Bailey, C.; Kawin, R.A.; Lann, N.A.; McGrogan, S.K.; Scott, W.S.; Stammers, S.M.; Thomas, J.L. (Lawrence Livermore National Lab., CA (USA)). Aug 1983. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE83017986.

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The Technology Information System (TIS) is being used to develop software for Intelligent Gateway Computers (IGC) suitable for the prototyping of advanced, integrated information networks. Dedicated to information management, TIS leads the user to available information resources, on TIS or elsewhere, by means of a master directory and automated access procedures. Other geographically distributed information centers accessible through TIS include federal and commercial systems like DOE/RECON, NASA/RECON, DOD/DROLS, DOT/TIC, CIS, and DIALOG in the United States, the chemical information systems DARC in France, and DECHEMA in West Germany. New centers are added as required.

9905 Civilian Defense

56811 **(CONF-8308119—1) Organizational and social-psychological issues relevant to fallout-shelter evaluation.** Wernette, D.R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01. Order Number DE83017931.

From American Sociological Association annual meeting; Detroit, MI, USA (31 Aug 1983).

This paper presents the results of a preliminary review of the literature on organizational and social-psychological issues relevant to fallout-shelter evaluation. Fallout-shelter options are evaluated along two dimensions: shelter size, and extent of shelteree participation in the shelter construction. Four functional criteria are used in the evaluation: decision-making, member coordination, social control, and maintaining morale. Smaller shelters requiring shelteree participation in construction appear preferable as measured in most of these criteria. Additional factors mentioned include demographic characteristics of the shelter population, degree and type of ventilation system, and availability of medical equipment and personnel. 10 references.

56812 **(ORNL—5958) Preliminary study of reducing the cost of blast shelter for critical workers.** Chester, C.V.; Holladay, D.W. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 163p. NTIS, PC A08/MF A01. Order Number DE84000522.

The overall purpose of this study was to examine ways to reduce the cost of shelter for critical workers. Shelters for this purpose would be expected to have from 10 to 100 spaces and overpressure protection from 340 to 1360 kPa (50 to 200 psi). The civil defense literature on cost was reviewed, and the cost estimates of the best designs were corrected to 1982 dollars. For shelters of the size and hardness of interest, costs generally run higher than $1000/space. Costs usually decrease significantly with increasing shelter size, and increase with hardness. Experiments with shelters in blast tests suggest that, for granular soil, corrugated metal culvert may be the most economical shelter material. A design and a cost estimate of a corrugated metal shelter exploiting earth-arching for 1360 kPa (200 psi) was carried through the concept stage. It is believed the configuration used will enable the occupants to survive both the ground motion and the initial nuclear radiation from megaton weapons at this overpressure. It appears that this shelter can be constructed for somewhat under $500/space, including habitability equipment, when purchased in relatively small numbers. A design concept for a very lightweight, high-overpressure door was developed. This door, using the membrane principle, offers the promise of being the lowest cost entranceway when in mass production. 44 references.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Academia Sinica, Beijing (China)
Linear relativistic gyrokinetic equation in general magnetically confined plasmas, 8:56711 (R;US)

Acton Research Corp., MA (USA)
Investigation of soft x-ray reflective coatings. Final report, February 1-August 30, 1983, 8:56749 (R;US)

Acurex Corp., Mountain View, CA (USA). Alternate Energy Div.
Feasibility study for alternate fuels production: unconventional natural gas from wastewater treatment plants. Volume I. Technical results, 8:55569 (R;US)
Feasibility study for alternate fuels production: unconventional natural gas from wastewater treatment plants. Volume II, Appendix D. Final report, 8:55570 (R;US)

Aerospace Corp., El Segundo, CA (USA). Eastern Technical Div.
Assessment of flywheel-system benefits in selected-vehicle applications, 8:55947 (R;US)

AiResearch Mfg. Co., Torrance, CA (USA)
High-temperature ceramic recuperator and combustion air burner programs. Semi-annual report Apr-Oct 81, 8:55923 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
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Qualifier
Title, (supplementary information), citation number, (R:US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC05-81OR20837	**Science Applications, Inc., Wayne, PA (USA)**	
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AC06-81NE44148	**International Energy Associates Ltd., Washington, DC (USA)**	
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
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AC13-79GJ01692	**High Life Helicopters, Inc., Puyallup, WA (USA)**	
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AC21-80MC14771	Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Chemical and Biochemical Engineering	
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AC22-82PC50046	Pittsburg and Midway Coal Mining Co., Denver, CO (USA)	
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8	*See* INIS-mf-8514	DE83703499	MN -70	8:55515
9	*See* INIS-mf-8516	DE83703500	MN -70	8:55517
10	*See* INIS-mf-8515	DE83703502	MN -70	8:55516
11	*See* INIS-mf-8517	DE83703503	MN -70	8:55518
12	*See* INIS-mf-8518	DE83703504	MN -70	8:55519
13	*See* INIS-mf-8519	DE83703505	MN -70	8:55520
14	*See* INIS-mf-8520	DE83703506	MN -70	8:55521
15	*See* INIS-mf-8521	DE83703507	MN -70	8:55522
16	*See* INIS-mf-8522	DE83703508	MN -70	8:55523
18	*See* INIS-mf-8524	DE83703510	MN -70	8:55525
19	*See* INIS-mf-8525	DE83703513	MN -70	8:55526
CONF-8209175-	(2. international conference on water and ions in biological systems, Bucharest, Romania, 6-11 Sep 1982)			
1	*See* LBL-15846	DE83017517	MN -61	8:56171
CONF-821051-	(International conference on fundamentals of thermochemical biomass conversion, Estes Park, CO, USA, 18-22 Oct 1982)			
6	*See* SERI/TP-234-1964	DE84000010	MN -61a	8:55572
CONF-821075-	(DOE geothermal engineering and materials program conference, San Diego, CA, USA, 6-8 Oct 1982)			
	See DOE/ET/27026-2	DE83017656	STD -66d	8:55681
CONF-8210106-	(Workshop on uses of nuclear analytical methods in metal toxicology, Upton, NY, USA, 11-12 Oct 1982)			
6	*See* BNL-33598	DE83018278	MN -48	8:56422

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CONF-8210155-	(Workshop on problems of nuclear astrophysics, Mainz, F.R. Germany, 13-15 Oct 1982)			
1	*See* KFK-3451	DE83751002	MN -34B	8:56539
CONF-8210168-	(10. annual Illinois energy conference, Chicago, IL, USA, 13-15 Oct 1982)			
	NTIS, PC A13/MF A01; 1	DE83014854	MN -98	8:55867
CONF-8210170-	(2. annual EPRI contractors' conference on coal gasification, Palo Alto, CA, USA, 20-21 Oct 1982)			
	See EPRI-AP-3121	DE83902657	MN -90c	8:55370
CONF-821127-	(ASM conference on current solutions to hydrogen problems in steels, Washington, DC, USA, 1 Nov 1982)			
3	*See* CEA-CONF-6519	DE83703429	MN -25	8:55962
CONF-821136-	(4. international conference on precipitation scavenging, dry deposition and resuspension, Santa Monica, CA, USA, 29 Nov-3 Dec 1982)			
25	*See* BNL-32839	DE83011354	MN -11	8:56308
CONF-821155-	(International meeting on research and test reactor core conversions from HEU to LEU fuels, Argonne, IL, USA, 8-10 Nov 1982)			
10	NTIS, PC A03/MF A01	DE83017336	MN -80	8:55774
CONF-821196-	(Gamma-gamma seminar, Montpellier, France, 1 Nov 1982)			
1	*See* DESY-83-011	DE83751029	MN -34D	8:56584
CONF-821214-	(8. geothermal reservoir engineering workshop, Stanford, CA, USA, 14-16 Dec 1982)			
	See SGP-TR-60	DE83015865	MN -66a	8:55699
CONF-821245-	(OCDE meeting on critical review of ductile fracture test methods, Paris, France, 1-3 Dec 1982)			
1	*See* CEA-CONF-6592	DE83703430	MN -25	8:55963
CONF-821248-	(5. Brazilian congress on materials science and engineering, Porto Alegre, Brazil, 13-15 Dec 1982)			
20	*See* INIS-BR-39	DE84780017	MN -02	8:55951
CONF-830149-	(5. finite element methods in flow problems, Austin, TX, USA, 23-26 Jan 1983)			
1	*See* SAND-83-1043C	DE84000042	MN -38	8:56224
CONF-830223-	(Wire chamber conference, Vienna, Austria, 15-18 Feb 1983)			
	See MPI-PAE/Exp.El.-112			8:56282
10	*See* DESY-83-014	DE83751028	MN -28	8:56274
CONF-830339-	(Theoretical symposium on intense medium energy sources of strangeness, Santa Cruz, CA, USA, 19-21 Mar 1983)			
5	*See* SLAC-PUB-3102	DE83018085	MN -34D	8:56608
CONF-830374-	(Moriond conference on electroweak interactions, Les Arcs, France, 13-19 Mar 1983)			
3	*See* SLAC-PUB-3124	DE83018084	MN -34D	8:56609
CONF-830449-	(DOE contractors workshop, Oak Ridge, TN, USA, 21-23 Apr 1983)			
4	NTIS, PC A02/MF A01; 1	DE83017956	MN -34	8:56553
CONF-830492-	(Association Francaise de Normalisation (AFNOR) meeting, Paris, France, 12 Apr 1983)			
2	NTIS, PC A02/MF A01	DE83011400	MN -13	8:56796
CONF-830528-	(7. international symposium on packaging and transportation of radioactive materials, New Orleans, LA, USA, 15-20 May 1983)			
59	*See* SAND-82-1927C	DE84000137	MN -71	8:56209
CONF-830573-	(2. international conference on radiation effects in insulators, Albuquerque, NM, USA, 30 May-3 Jun 1983)			
8	NTIS, PC A02/MF A01	DE84000599	MN -34A	8:56683
CONF-8305109-	(7. Nobel conference on positron emission tomography, Stockholm, Sweden, 17-20 May 1983)			
2	*See* BNL-33679	DE83018299	MN -48	8:56384
CONF-8305133-	(Southwest regional conference on astronomy and astrophysics, Fort Davis, TX, USA, 13-14 May 1983)			
1	*See* LA-UR-83-2329	DE83017304	MN -34B	8:56540
CONF-8305135-	(Conference on the role of cocarcinogens and promoters in human and experimental carcinogenesis, Budapest, Hungary, 16-18 May 1983)			
1	NTIS, PC A03/MF A01	DE84000570	MN -48	8:56469
CONF-8305136-	(17. Aerospace Mechanisms symposium, Pasadena, CA, USA, 5-6 May 1983)			
	See N-8324881			8:56207
CONF-830621-	(IEEE power electronics specialists conference, Albuquerque, NM, USA, 6-9 Jun 1983)			
42	*See* UCRL-88670	DE83018184	MN -21	8:56776
44	*See* UCRL-88668	DE83018027	MN -21	8:56775
CONF-830635-	(19. AIAA-SAE-ASME joint propulsion conference, Seattle, WA, USA, 27-29 Jun 1983)			
2	*See* N-8323545			8:56245
CONF-830675-	(6. high energy heavy ion study and 2. workshop on anomalons, Berkeley, CA, USA, 28 Jun-1 Jul 1983)			
6	NTIS, PC A02/MF A01	DE83017958	MN -34D	8:56603
CONF-830689-	(14. international symposium on multiparticle dynamics, Lake Tahoe, NV, USA, 22-27 Jun 1983)			
4	*See* ANL-HEP-CP-83-54	DE84000590	MN -34D	8:56580
CONF-8306127-	(4. annual weak interactions conference, Philadelphia, PA, USA, 1 Jun 1983)			
1	*See* PNL-SA-11555	DE84000476	MN -34C	8:56676

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CONF-830702-	(21. ASME/AIChE national heat transfer conference, Seattle, WA, USA, 24-28 Jul 1983)			
7-Rev.2	*See* UCRL-88649-Rev.2	DE84000165	MN -11	8:56324
CONF-830706-	(13. international conference on the physics of electronic and atomic collisions (ICPEAC), Berlin, F.R. Germany, 27 Jul-2 Aug 1983)			
7	NTIS MF A01; 2	DE84000364	MN -4	8:56554
CONF-830718-	(International Europhysics conference on high energy physics, Brighton, UK, 20-27 Jul 1983)			
7	*See* BNL-33650	DE83018279	MN -34D	8:56581
CONF-830719-	(American Physical Society meeting on shock waves in condensed media, Santa Fe, NM, USA, 18-21 Jul 1983)			
44	*See* UCRL-88682	DE84000071	MN -21	8:56777
52	*See* SAND-83-0804C	DE83017801	MN -25	8:56079
53	*See* UCRL-88974	DE84000158	MN -25	8:55995
CONF-830763-	(9. AIRAPT conference, Albany, NY, USA, 25-29 Jul 1983)			
14	NTIS MF A01; 2	DE83017960	MN -4	8:56136
16	*See* LA-UR-83-2830	DE84001034	MN -34	8:55982
CONF-830768-	(9. International Association for the Advancement of High Pressure Science and Technology conference, Albany, NY, USA, 25-28 Jul 1983)			
2	*See* UCRL-89712	DE84000153	MN -25	8:55996
3	*See* UCRL-89713	DE84000157	MN -4	8:56105
CONF-830779-	(6. international conference on hyperfine interactions, Groningen, Netherlands, 4-8 Jul 1983)			
3	*See* UCRL-89741	DE84000070	MN -25	8:55997
CONF-830798-	(3. LAMPF II workshop, Los Alamos, NM, USA, 18-29 Jul 1983)			
2	*See* BNL-33622	DE83017913	MN -37	8:56273
CONF-830799-	(International ultrasonics conference, Halifax, Nova Scotia, 12-14 Jul 1983)			
1	NTIS, PC A02/MF A01	DE83017923	MN -25	8:56229
CONF-8307100-	(TRIUMF workshop on studying nuclei with medium energy protons, Alberta, Canada, 11-13 Jul 1983)			
1	*See* LA-UR-83-2531	DE83017317	MN -34C	8:56658
CONF-830805-	(7. international conference on structural mechanics in reactor technology, Chicago, IL, USA, 22-26 Aug 1983)			
60	*See* EGG-M-04883	DE84000895	ND -38	8:56230
CONF-830808-	(International solvent extraction conference, Denver, CO, USA, 26 Aug-2 Sep 1983)			
11	NTIS, PC A02/MF A01	DE84000201	MN -4	8:56137
12	NTIS, PC A02/MF A01	DE84000202	MN -86	8:55486
CONF-830811-	(Conference on quantitative NDE, Santa Cruz, CA, USA, 7-12 Aug 1983)			
13	*See* IS-M-441	DE83018086	MN -34	8:56232
14	*See* IS-M-460	DE83018092	MN -34	8:56234
15	*See* IS-M-448	DE83018083	MN -25	8:56233
CONF-830812-	(18. intersociety energy conversion engineering conference, Orlando, FL, USA, 21-26 Aug 1983)			
54	*See* EGG-M-00283	DE84000664	MN -66a	8:55676
55	*See* EGG-M-00383	DE84000663	MN -66a	8:55677
56	*See* N-8324571			8:55891
CONF-830822-	(12. international conference on high energy accelerators, Batavia, IL, USA, 11-16 Aug 1983)			
23	*See* LBL-16483	DE83017747	MN -28	8:56253
24	*See* BNL-33607	DE83017762	MN -28	8:56257
25	*See* BNL-33609	DE83017875	MN -28	8:56258
27	NTIS, PC A02/MF A01; 1	DE84000589	MN -28	8:56255
CONF-830841-	(Cryogenic engineering conference and international cryogenic materials conference, Colorado Springs, CO, USA, 15-19 Aug 1983)			
20	*See* LBL-16505	DE83017741	MN -28	8:56267
22	*See* BNL-33602	DE83018187	MN -25	8:56203
23	*See* BNL-33601	DE83018186	MN -25	8:55958
24	*See* BNL-33600	DE83018189	MN -25	8:55957
25	*See* N-8324798			8:56205
CONF-830847-	(Energy resource management '83, San Francisco, CA, USA, 23-27 Aug 1983)			
2	NTIS, PC A02/MF A01	DE84000585	MN -96	8:55904
3	NTIS, PC A02/MF A01	DE84000600	MN -96	8:55905
CONF-830859-	(National meeting of the American Institute of Chemical Engineers, Denver, CO, USA, 28-31 Aug 1983)			
9	NTIS, PC A02/MF A01	DE84000567	MN -4	8:56138
CONF-830888-	(5. international conference on liquid and amorphous metals, Los Angeles, CA, USA, 15-19 Aug 1983)			
9	*See* BNL-33604	DE84001206	MN -25	8:55959
10	*See* BNL-33605	DE84001203	MN -25	8:55960
CONF-830895-	(10. international conference on amorphous and liquid semiconductors, Tokyo, Japan, 22 Aug 1983)			
8	*See* BNL-33439	DE83016730	MN -63c	8:55587
CONF-830899-	(Annual meeting of American Statistical Association and other statistical groups, Toronto, Canada, 15-18 Aug 1983)			
1	*See* PNL-SA-11221	DE83016741	MN -11	8:56351

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CONF-8308100-	(91. annual meeting of the American Psychological Association, Anaheim, CA, USA, 27 Aug-2 Sep 1983)			
6	*See* PNL-SA-11598	DE84000479	MN -2	8:55739
CONF-8308101-	(International symposium on lepton and photon interactions at high energies, Ithaca, NY, USA, 4-9 Sep 1983)			
4	*See* ANL-HEP-CP-83-41	DE84000573	MN -34D	8:56579
CONF-8308106-	(5th. annual participants information meeting of DOE low level waste management program, Denver, CO, USA, 30 Aug-1 Sep 1983)			
6	*See* BNL-NUREG-33618	DE83018291	MN -78	8:55740
7	*See* PNL-SA-11537	DE84000121	MN -70B	8:56524
9	*See* BNL-NUREG-33641	DE84000622	MN -70	8:56091
10	NTIS, PC A02/MF A01	DE84000718	MN -70B	8:55501
11	*See* BNL-NUREG-33627	DE84000621	MN -70	8:55499
12	*See* EGG-M-18883	DE84000726	MN -70B	8:55507
13	*See* LA-UR-83-2591	DE84001352	MN -70B	8:55528
CONF-8308109-	(3. international congress on toxicology, San Diego, CA, USA, 28 Aug-3 Sep 1983)			
2	*See* PNL-SA-10966	DE84000119	MN -90a	8:55441
CONF-8308110-	(6. international congress on photosynthesis, Brussels, Belgium, 1-6 Aug 1983)			
4	*See* BNL-33553	DE83017982	MN -48	8:56382
5	NTIS, PC A02/MF A01	DE83017226	MN -48	8:56374
CONF-8308111-	(Conference on the future of nuclear power, Nara, Japan, 22-24 Aug 1983)			
2	NTIS, PC A02/MF A01	DE83017221	MN -70	8:55502
CONF-8308112-	(3. international Swarm seminar, Innsbruck, Austria, 3-5 Aug 1983)			
3	NTIS, PC A02/MF A01; 1	DE84000363	MN -4	8:56556
CONF-8308113-	(2. biennial meeting of the Institute for Ultimate Reality and Meaning, Toronto, Canada, 17-20 Aug 1983)			
1	NTIS, PC A03/MF A01	DE83017953	MN -34	8:56698
2	NTIS, PC A03/MF A01	DE83017952	MN -13	8:55825
CONF-8308117-	(2. international symposium on acoustic remote sensing of the atmosphere and ocean, Rome, Italy, 29 Aug-2 Sep 1983)			
1	NTIS, PC A02/MF A01	DE83017942	MN -11	8:56303
2	NTIS, PC A02/MF A01	DE83017930	MN -11	8:56304
CONF-8308118-	(Annual geochemistry review, Washington, DC, USA, 29 Aug-1 Sep 1983)			
1	*See* PNL-SA-11603	DE83017857	MN -70A	8:55540
CONF-8308119-	(American Sociological Association annual meeting, Detroit, MI, USA, 31 Aug-4 Sep 1983)			
1	NTIS, PC A02/MF A01	DE83017931	MN -41	8:56811
CONF-8308121-	(International symposium on foundations of quantum mechanics, Kokubunji, Japan, 29 Aug 1983)			
1	NTIS, PC A02/MF A01	DE83017928	MN -34A	8:56690
CONF-8308123-	(4. international conference on phonon scattering in condensed matter, Stuttgart, F.R. Germany, 22-26 Aug 1983)			
1	*See* LA-UR-83-2379	DE83017229	MN -34D	8:56685
CONF-8308124-	(Symposium on validation and predictability of lab methods for the assessment of effects on environmental contaminants in aquatic ecosystems, Grand Forks, ND, USA, 8 Aug 1983)			
1	NTIS, PC A03/MF A01	DE83017224	MN -90i	8:55416
CONF-8308125-	(3. international conference on recent progress in many-body theories, Altenberg, F.R. Germany, 29 Aug-3 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84000164	MN -34	8:56571
2	NTIS, PC A02/MF A01	DE84000163	MN -34C	8:56672
3	NTIS, PC A02/MF A01	DE84000162	MN -34D	8:56673
CONF-8308126-	(NRC research annual review meeting, Reston, VA, USA, 30 Aug-1 Sep 1983)			
1-Draft	NTIS, PC A02/MF A01	DE84000731	MN -70	8:55545
CONF-8308127-	(26. Midwest symposium on circuits and systems, Puebla, Mexico, 15-16 Aug 1983)			
1	*See* UCRL-89706	DE84000156	MN -38	8:56807
CONF-830905-	(Joint power generation conference, Indianapolis, IN, USA, 25-29 Sep 1983)			
7	*See* PNL-SA-11614	DE83018283	MN -85	8:55494
8	*See* SAND-83-2092C	DE84000464	MN -71	8:55495
CONF-830910-	(3. national conference on synchrotron radiation instrumentation, Upton, NY, USA, 12-14 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84000345	MN -28	8:56271
CONF-830911-	(5. international conference on high power particle beams, San Francisco, CA, USA, 12-14 Sep 1983)			
14	*See* SAND-83-1375C	DE84000116	MN -21	8:56769
15	*See* SAND-83-1773C	DE84000115	MN -21	8:56770
17	*See* SAND-83-0541C	DE84000102	MN -21	8:56768
CONF-830920-	(7. symposium on sources and ion assisted technology and 4. international conference on ion and plasma assisted techniques, Kyoto, Japan, 12-16 Sep 1983)			
9	NTIS, PC A03/MF A01; 1	DE84000684	MN -34A	8:56555
CONF-830938-	(Symposium on computer analysis of electric load forecasting and generating capacity expansion, Columbus, OH, USA, 14-16 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84000728	MN -97c	8:55874

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CONF-830939-	(Waterpower '83 - international conference on hydropower, Knoxville, TN, USA, 18-21 Sep 1983)			
1	*See* EGG-M-16683	DE84000808	MN -97e	8:55577
2	*See* EGG-M-02983	DE84000809	MN -97e	8:55576
CONF-830942-	(3. topical meeting on fusion reactor materials, Albuquerque, NM, USA, 19-23 Sep 1983)			
6	*See* PNL-SA-11454	DE84000602	MN -20c	8:56763
7	NTIS, PC A02/MF A01; 1	DE84000593	MN -20c	8:55965
8	NTIS, PC A02/MF A01	DE84000565	MN -20c	8:55966
9	NTIS, PC A02/MF A01	DE84000597	MN -20c	8:55967
10	*See* PNL-SA-11363	DE84000120	MN -20c	8:55990
11	*See* SAND-83-1028C	DE84000051	MN -20c	8:55993
12	*See* PNL-SA-11425	DE84000477	MN -20c	8:55991
13	*See* PNL-SA-11320	DE84000103	MN -20c	8:55989
14	NTIS, PC A02/MF A01	DE84000598	MN -20c	8:56742
15	NTIS, PC A02/MF A01	DE84000611	MN -20c	8:55968
16	NTIS, PC A02/MF A01; 1	DE84000411	MN -20c	8:55969
22	NTIS, PC A02/MF A01	DE84000725	MN -20c	8:55970
24	NTIS, PC A02/MF A01	DE84000610	MN -20c	8:56743
25	NTIS, PC A02/MF A01	DE84000342	MN -20c	8:56744
26	NTIS, PC A02/MF A01	DE84000330	MN -20c	8:55971
27	NTIS, PC A02/MF A01	DE84000341	MN -20c	8:55972
28	NTIS, PC A02/MF A01	DE84000339	MN -20c	8:55973
29	NTIS, PC A02/MF A01; 1	DE84000338	MN -20c	8:56745
30	*See* EGG-M-18183	DE84000806	MN -20c	8:56750
33	NTIS, PC A02/MF A01	DE84000260	MN -20c	8:55974
35	*See* LA-UR-83-2566	DE84001399	MN -34C	8:55981
CONF-830969-	(12. international conference on solid state nuclear track detectors, Acapulco, Mexico, 4-10 Sep 1983)			
1-Rev.	*See* PNL-SA-11213-Rev.	DE84001005	MN -37	8:56287
CONF-830971-	(8. international conference on magnet technology and exhibition, Grenoble, France, 5-9 Sep 1983)			
4	NTIS, PC A02/MF A01; 1	DE84000717	MN -20b	8:56746
CONF-830974-	(Physical and chemical energy storage annual contractors' review meeting, Arlington, VA, USA, 12-14 Sep 1983)			
8	*See* SERI/TP-252-2055	DE84000001	STD -62e	8:55624
Summ.	NTIS, PC A04/MF A01	DE83017802	STD -94	8:55812
CONF-830976-	(12. North American Thermal Analysis Society and 38. calorimetry conference, Williamsburg, VA, USA, 25-29 Sep 1983)			
4	*See* MLM-3106(OP)	DE84000361	MN -25	8:56089
CONF-8309103-	(9. international vacuum congress and 5. international conference on solid surfaces, Madrid, Spain, 26 Sep-1 Oct 1983)			
8	*See* UCRL-88987	DE83018181	MN -20	8:56778
9	NTIS, PC A02/MF A01; 1	DE84000586	MN -20a	8:56702
CONF-8309127-	(International Nuclear Target Society workshop, Argonne, IL, USA, 7-9 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84000255	MN -22	8:55552
2	NTIS, PC A02/MF A01	DE84000719	MN -38	8:56260
CONF-8309135-	(Computational engineering mechanics conference, Dalian, China, 4-10 Sep 1983)			
3	*See* LA-UR-83-2493	DE83017312	MN -32	8:56799
4	*See* UCRL-89709	DE84000154	MN -25	8:56688
CONF-8309142-	(3. conference on hot plasma diagnostics, Dubna, USSR, 12-16 Sep 1983)			
1	*See* UCRL-89345	DE83017834	MN -20	8:56728
CONF-8309144-	(EPS conference on computing in accelerator design and operation, Berlin, F.R. Germany, 20-23 Sep 1983)			
1	*See* BNL-33652	DE83010935	MN -28	8:56270
CONF-8309145-	(10. American Society for Quality Control annual energy division conference, San Diego, CA, USA, 18-21 Sep 1983)			
1	*See* UCRL-89328	DE83018188	MN -21	8:56780
CONF-8309146-	(8. international meeting on n-nitroso compounds: occurrence and biological effects, Banff, Alberta, Canada, 4-9 Sep 1983)			
1	*See* BNL-33557	DE83017981	MN -48	8:56467
CONF-8309147-	(3. international workshop on plasma focus research, Stuttgart, F.R. Germany, 12-13 Sep 1983)			
1	*See* LA-UR-83-2311	DE83017311	MN -20f	8:56719
CONF-8309148-	(SIMS conference on atomic bomb survivor data - utilization and analysis, Alta, UT, USA, 12-16 Sep 1983)			
1	*See* PNL-SA-11596	DE84000111	MN -41	8:56455
CONF-8309150-	(International workshop on stable isotopes in the assessment of natural and anthropogenic sulfur in the environment, Pushchino, USSR, 9-16 Sep 1983)			
1	NTIS, PC A02/MF A01; 1	DE84000566	MN -11	8:56309
CONF-8309151-	(Labcon central '83 conference, Chicago, IL, USA, 19-23 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84000259	MN -4	8:56532
CONF-8309156-	(7. meeting of the international collaboration on advanced neutron sources, Ontario, Canada, 12-16 Sep 1983)			
4	NTIS, PC A02/MF A01; 1	DE84000584	MN -25	8:56099
CONF-8309159-	(Flexible Manufacturing Systems-West seminar, Anaheim, CA, USA, 20 Sep 1983)			
1	*See* UCRL-89746	DE83017373	MN -38	8:56201

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CONF-8309162-	(5. annual EOS/ESD symposium, Las Vegas, NV, USA, 27 Sep 1983)			
1	*See* SAND-83-1045C	DE84000138	MN -38	8:56290
CONF-8310143-	(11. NRC water reactor safety research information meeting, Gaithersburg, MD, USA, 14-28 Oct 1983)			
2	*See* BNL-NUREG-33664	DE83017944	MN -78	8:55776
CONF-8310159-	(Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics, Lake Ozard, MO, USA, 31 Oct-2 Nov 1983)			
3	*See* SAND-83-0944C	DE84000449	MN -4	8:56128
CONF-8310162-	(Western gas sands sub-program review meeting, Morgantown, WV, USA, 18-19 Oct 1983)			
1	*See* SAND-83-2100C	DE84000352	MN -92a	8:55463
2	*See* SAND-83-2053C	DE84000454	MN -92	8:56530
4	*See* SAND-83-2140C	DE84000483	MN -92a	8:55458
5	*See* SAND-83-1827C	DE84000351	MN -92a	8:55462
6	NTIS, PC A02/MF A01	DE84000486	MN -91	8:55461
7	*See* SAND-83-2135C	DE84000943	MN -92a	8:55457
CONF-8310163-	(18. international thermal conductivity conference, Rapid City, SD, USA, 3-5 Oct 1983)			
1	*See* SAND-83-2134C	DE84000353	MN -34	8:55994
2	*See* SAND-83-2084C	DE84000451	MN -38	8:56294
CONF-8310164-	(2. symposium on electromagnetic launch technology, Boston, MA, USA, 11-14 Oct 1983)			
1	*See* UCRL-89834	DE84000470	MN -38	8:56781
2	*See* LA-UR-83-2579	DE84001361	MN -38	8:56204
CONF-8310165-	(National electronics conference, Chicago, IL, USA, 23-26 Oct 1983)			
1	*See* UCRL-89666	DE84000166	MN -38	8:56806
CONF-8310166-	(54. shock and vibration symposium, Pasadena, CA, USA, 18-19 Oct 1983)			
1	*See* SAND-83-1372C	DE84000482	MN -38	8:56235
CONF-8310167-	(NATO-AGARD lecture series number 131, Ankara, Turkey, 19-28 Oct 1983)			
1	*See* UCRL-89613	DE83015451	MN -38	8:56239
CONF-8310170-	(International symposium on peat utilization, Bemidji, MI, USA, 11-13 Oct 1983)			
1	*See* LA-UR-83-2578	DE84001360	MN -4	8:55395
CONF-831102-	(Conference on effects of SO/sub 2/ on plant productivity, Palo Alto, CA, USA, 28 Nov-2 Dec 1983)			
1	*See* UCRL-89013	DE83010259	MN -11	8:56517
CONF-831104-	(National fuel cell seminar, Orlando, FL, USA, 13-16 Nov 1983)			
2	NTIS, PC A02/MF A01	DE84000612	MN -93	8:55888
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Absts.	*See* LBL-16289	DE83015706	MN -20a	8:56720
CONF-831111-	(ASME winter annual meeting, Boston, MA, USA, 13-18 Nov 1983)			
1	*See* DOE/ER/13008-2	DE83011934	MN -38	8:56220
5	*See* UCRL-89385	DE83014946	MN -32	8:56805
7	*See* LA-UR-83-2364	DE83017322	MN -66c	8:55653
8	*See* UCRL-89602	DE83017618	MN -38	8:56225
CONF-831160-	(24. annual meeting of transportation research forum, Crystal City, VA, USA, 2-5 Nov 1983)			
1	NTIS, PC A02/MF A01	DE83015373	MN -96	8:55906
2	NTIS, PC A02/MF A01	DE83015375	MN -96	8:55907
CONF-831171-	(American Vacuum Society meeting, Boston, MA, USA, 1-4 Nov 1983)			
1	*See* UCRL-89277	DE83016942	MN -20	8:56779
2	*See* SAND-83-1303C	DE83017561	MN -25	8:56104
3	*See* UCRL-89189	DE84000174	MN -4	8:56330
5	*See* LA-UR-83-2689	DE84001324	MN -4	8:56152
7	*See* LBL-15868	DE84000956	MN -4	8:55983
CONF-831174-	(Materials Research Society annual meeting, Boston, MA, USA, 14-17 Nov 1983)			
1	NTIS, PC A02/MF A01	DE84000845	MN -41	8:55548
2	*See* LA-UR-83-2838	DE84001036	MN -4	8:56153
CONF-831187-	(MMM conference, Pittsburg, PA, USA, 8-11 Nov 1983)			
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4	*See* LA-UR-83-2775	DE84001319	MN -25	8:56077
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1	Ann. N.Y. Acad. Sci., 404: 457-460(1983)			8:55561
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1	Ann. N.Y. Acad. Sci., 404: 432-452(1983)			8:56118
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228-U	NTIS (US Sales Only), PC A06/MF A01; 1	DE84900054	MN -34C	8:56669
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3770347	NTIS (US Sales Only), PC A02/MF A01	DE83770347	MN -98	8:55865
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3770370	NTIS (US Sales Only), PC A20/MF A01; 1	DE83770370	MN -61a	8:55598
3770371	NTIS (US Sales Only), PC A03/MF A01	DE83770371	MN -98	8:55835
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3770374	NTIS (US Sales Only), PC A08/MF A01; 1	DE83770374	MN -38	8:56127
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3770376	NTIS (US Sales Only), PC A07/MF A01; 1	DE83770376	MN -97a	8:55731
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3770378	NTIS (US Sales Only), PC A02/MF A01	DE83770378	MN -25	8:56102
3770379	NTIS (US Sales Only), PC A02/MF A01; 1	DE83770379	MN -92b	8:55453
3770380	NTIS (US Sales Only), PC A04/MF A01	DE83770380	MN -58	8:55618

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3770381	NTIS (US Sales Only), PC A02/MF A01	DE83770381	MN -58	8:55586
3770382	NTIS (US Sales Only), PC A04/MF A01; 1	DE83770382	MN -92	8:55870
3770383	NTIS (US Sales Only), PC A04/MF A01; 1	DE83770383	MN -25	8:55952
3770384	NTIS (US Sales Only); 2	DE83770384	MN -96	8:55936
3770385	NTIS (US Sales Only), PC A07/MF A01; 1	DE83770385	MN -11	8:56342
3770386	NTIS (US Sales Only), PC A12/MF A01; 1	DE83770386	MN -11	8:56354
3770387	NTIS (US Sales Only), PC A02/MF A01	DE83770387	MN -92	8:55950
3770389	NTIS (US Sales Only), PC A07/MF A01	DE83770389	MN -96	8:55942
3770390	NTIS (US Sales Only), PC A07/MF A01; 1	DE83770390	MN -95d	8:55899
3770391	NTIS (US Sales Only), PC A09/MF A01; 1	DE83770391	MN -38	8:55937
3770392	NTIS (US Sales Only), PC A08/MF A01; 1	DE83770392	MN -38	8:55938
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3902704	NTIS, PC A95/MF A01; 1	DE83902704	MN -88	8:55422
3902736	NTIS (US Sales Only), PC A08/MF A01; 1	DE83902736	MN -98B	8:55824
3903021	NTIS, PC A05/MF A01; 1	DE83903021	MN -41	8:55549
3910799	NTIS, PC A04/MF A01; 1	DE83910799	MN -11	8:55826
3910810	Colorado Geological Survey, Dept. of Natural Resources, Denver, CO 80203		MN -11	8:55839
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0020-Vol.7-No.6	NTIS, PC A17/MF A01; 1 - GPO	DE84900068	MN -80	8:55764
0383-Vol.1-Rev.6	NTIS, PC A19/MF A01 - GPO $8.50	DE84900035	MN -16	8:56208
0383-Vol.2-Rev.6	NTIS, PC A99/MF A01 - GPO $11.00	DE84900043	MN -71	8:55490
0383-Vol.3-Rev.3	NTIS, PC A07/MF A01 - GPO $5.50	DE84900037	MN -71	8:55491
0750-Vol.17-No.4	NTIS, PC A10/MF A01 - GPO	DE84900070	MN -2	8:55765
0852-Suppl.2	NTIS, PC A08/MF A01; 1 - GPO $6.00	DE84900069	MN -78	8:55789
1022	NTIS, PC A05/MF A01 - GPO $4.50	DE84900039	MN -80	8:55790
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0043	NTIS, PC A99/MF A01; 1 - GPO $13.00	DE83902053	MN -78	8:55736
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2970-Vol.3	NTIS, PC A04/MF A01 - GPO	DE84000183	MN -78	8:55805
3118-Vol.1	NTIS, PC A03/MF A01 - GPO $3.75	DE84900063	MN -41	8:56514
3118-Vol.3	NTIS, PC A09/MF A01 - GPO $6.00	DE84900060	MN -41	8:56515
3203	NTIS, PC A04/MF A01; 1 - GPO	DE84000480	MN -70	8:55530
3277	NTIS PC E08/MF A01 - GPO	DE84000175	MN -78	8:55806
3327	NTIS, PC A04/MF A01; 1 - GPO $4.50	DE84900067	MN -11	8:56529
3414	NTIS, PC A06/MF A01 - GPO	DE84000442	MN -80	8:55733
3416-Vol.1	NTIS, PC A06/MF A01; 1 - GPO $5.00	DE84900062	MN -80	8:55737
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3437	NTIS, PC A03/MF A01 - GPO	DE84000488	MN -80	8:55807
3447-Vol.1	NTIS, PC A05/MF A01; 1 - GPO $4.50	DE83910798	MN -2	8:56791
3452	NTIS, PC A03/MF A01 - GPO	DE84000558	MN -71	8:55492
3472-Vol.1	NTIS, PC A06/MF A01 - GPO $4.75	DE84900049	MN -70	8:55531
3475	NTIS, PC A13/MF A01; 1 - GPO $7.00	DE84000444	MN -78	8:55808
3487	NTIS, PC A06/MF A01; 1 - GPO $5.00	DE84900066	MN -70B	8:55532
3494	NTIS, PC A08/MF A01; 1 - GPO	DE84000515	MN -15	8:55533
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455	NTIS, PC A03/MF A01	DE84001218	STD -70	8:55534
493	NTIS, PC A03/MF A01	DE84001008	MN -70	8:55535
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5887	NTIS, PC A13/MF A01	DE84000039	STD -70	8:55536
5958	NTIS, PC A08/MF A01	DE84000522	STD -41	8:56812
5975	NTIS, PC A13/MF A01; 1	DE84000296	MN -13	8:56686
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97	NTIS, PC A05/MF A01	DE84000654	MN -95d	8:55900
123	NTIS, PC A07/MF A01	DE84000648	STD -97b	8:55726
132	NTIS, PC A06/MF A01; 1	DE84000292	MN -95e	8:55901
137	NTIS, PC A03/MF A01	DE84000655	MN -13	8:55902
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80-28906/ 2	NTIS, PC A08/MF A01; 1	DE84000303	MN -95d	8:55922
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8447	NTIS, PC A13/MF A01	DE84000195	MN -11	8:56363
8508	NTIS, PC A03/MF A01; 1	DE84000291	MN -90d	8:55384
8604	NTIS, PC A04/MF A01	DE84000615	MN -90e	8:55436
8611	NTIS, PC A04/MF A01; 1	DE84000657	STD -90d	8:55385
8624-Vol.2	NTIS, PC A14/MF A01; 1	DE84000634	MN -90d	8:55386
8627	NTIS, PC A08/MF A01; 1	DE84000350	MN -25	8:55987
8689	*See* NUREG/CR-3203	DE84000480	MN -70	8:55530
8694	NTIS, PC A02/MF A01	DE84000616	STD -70	8:55537
8708	NTIS, PC A03/MF A01	DE84000651	STD -90d	8:55387
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8738	NTIS, PC A03/MF A01	DE84000652	STD -20f	8:56721
8757	NTIS, PC A05/MF A01	DE84000656	MN -90c	8:55388
8803	NTIS, PC A02/MF A01; 1	DE84000650	STD -20f	8:56762
8804	NTIS, PC A04/MF A01	DE84000617	STD -20	8:56722
8821	NTIS, PC A04/MF A01	DE84000649	MN -48	8:56516
8830	NTIS, PC A03/MF A01	DE84000244	MN -25	8:55988
8843	NTIS, PC A04/MF A01; 1	DE84000290	MN -96	8:55908
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8850	NTIS, PC A03/MF A01	DE84000295	MN -92a	8:55871
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8892	NTIS, PC A09/MF A01; 1	DE84000297	MN -13	8:55756
8907	NTIS, PC A03/MF A01	DE84000298	MN -90b	8:55430
OTA-				
3903086	NTIS, PC A05/MF A01	DE83903086	MN -11	8:55827
3910800	NTIS, PC A05/MF A01; 1	DE83910800	MN -11	8:55828
3910804	NTIS, PC A03/MF A01; 1	DE83910804	MN -11	8:55829
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A 6-356,574				8:55603
A 6-426,447		DE83018036	MN -20	8:55563
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83-200444	NTIS PC E07/MF E07			8:55757
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3499	NTIS, PC A04/MF A01; 1	DE84000605	MN -60	8:55718
3982	NTIS, PC A04/MF A01	DE84000852	MN -41	8:56286
4568	NTIS, PC A04/MF A01	DE83017910	MN -96	8:55939
4658	NTIS, PC A04/MF A01	DE84001254	MN -41	8:56349
4670	NTIS, PC A03/MF A01	DE84001350	MN -41	8:56329
4779	NTIS, PC A05/MF A01	DE84000580	MN -61a	8:55571
4796	NTIS, PC A04/MF A01	DE83017897	MN -70B	8:55538
4801	NTIS, PC A03/MF A01	DE84001310	MN -70A	8:56350
4819	NTIS, PC A11/MF A01; 1	DE84001019	MN -70	8:55539
4836	NTIS, PC A04/MF A01	DE84000851	MN -90d	8:55389
4842	*See* DOE/UMT-0216	DE84001253	MN -70	8:55506
4857	NTIS, PC A05/MF A01	DE84000190	MN -85	8:55493
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10966	NTIS, PC A02/MF A01	DE84000119	MN -90a	8:55441
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11221	NTIS, PC A03/MF A01	DE83016741	MN -11	8:56351
11320	NTIS, PC A02/MF A01; 1	DE84000103	MN -20c	8:55989
11363	NTIS, PC A02/MF A01; 1	DE84000120	MN -20c	8:55990
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11454	NTIS, PC A02/MF A01; 1	DE84000602	MN -20c	8:56763
11537	NTIS, PC A02/MF A01	DE84000121	MN -70B	8:56524
11555	NTIS, PC A02/MF A01	DE84000476	MN -34C	8:56676
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2008	NTIS, PC A03/MF A01; 1	DE84000521	MN -20d	8:56764
2031	NTIS, PC A04/MF A01	DE84000176	STD -20g	8:56723
2032	NTIS, PC A07/MF A01	DE83017363	STD -20	8:56765
2035	NTIS, PC A02/MF A01	DE84000908	STD -20g	8:56724
2036	NTIS, PC A03/MF A01	DE84000906	STD -20g	8:56766
2037	NTIS, PC A03/MF A01	DE84000907	STD -20g	8:56725
2041	NTIS, PC A02/MF A01	DE83017812	STD -20d	8:56767
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363	*See* DOE/PC/30294-8	DE83017562	STD -90e	8:55433
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35	NTIS (US Sales Only), PC A03/MF A01	DE83751049	MN -37	8:56272
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665	*See* N-8322088			8:56544
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3541	NTIS, PC A02/MF A01	DE84000847	STD -10	8:56103
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83-24P	NTIS, PC A08/MF A01; 1	DE84000533	MN -70	8:55547

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SAI-				
83-046-CH	*See* PB-83-228437			8:56249
SAND-				
77-8239	NTIS, PC A03/MF A01	DE84000633	MN -32	8:56800
81-7081/ 1	NTIS, PC A11/MF A01; 1	DE84000966	MN -63d	8:55606
81-7082	NTIS, PC A07/MF A01; 1	DE84000962	MN -63d	8:55607
81-7085/ 20	NTIS, PC A03/MF A01; 1	DE84000971	STD -63d	8:55608
81-7086/ 20	NTIS, PC A03/MF A01; 1	DE84000965	STD -63d	8:55609
81-7087/ 10	NTIS, PC A04/MF A01; 1	DE84000970	STD -63d	8:55610
82-1425	NTIS, PC A02/MF A01	DE84000978	MN -38	8:56238
82-1927C	NTIS, PC A02/MF A01; 1	DE84000137	MN -71	8:56209
82-2498	NTIS, PC A02/MF A01	DE84000979	MN -25	8:55992
83-0534	NTIS, PC A03/MF A01	DE84000986	MN -90d	8:55390
83-0541C	NTIS, PC A02/MF A01; 1	DE84000102	MN -21	8:56768
83-0637	NTIS, PC A06/MF A01; 1	DE83018261	MN -32	8:56801
83-0678	NTIS, PC A03/MF A01	DE84000976	MN -70	8:55541
83-0757	NTIS, PC A06/MF A01; 1	DE84000968	MN -70	8:55542
83-0804C	NTIS, PC A02/MF A01; 1	DE83017801	MN -25	8:56079
83-0944C	NTIS, PC A02/MF A01	DE84000449	MN -4	8:56128
83-1028C	NTIS MF A01; 2	DE84000051	MN -20c	8:55993
83-1038	*See* NUREG/CR-3277	DE84000175	MN -78	8:55806
83-1043C	NTIS, PC A02/MF A01; 1	DE84000042	MN -38	8:56224
83-1045C	NTIS, PC A02/MF A01; 1	DE84000138	MN -38	8:56290
83-1296	NTIS, PC A03/MF A01	DE84000975	MN -70	8:55550
83-1303C	NTIS, PC A02/MF A01	DE83017561	MN -25	8:56104
83-1372C	NTIS, PC A03/MF A01; 1	DE84000482	MN -38	8:56235
83-1375C	NTIS, PC A02/MF A01	DE84000116	MN -21	8:56769
83-1731	NTIS, PC A03/MF A01	DE84000969	MN -32	8:56802
83-1773C	NTIS, PC A02/MF A01	DE84000115	MN -21	8:56770
83-1827C	NTIS, PC A02/MF A01; 1	DE84000351	MN -92a	8:55462
83-2053C	NTIS, PC A02/MF A01; 1	DE84000454	MN -92	8:56530
83-2084C	NTIS, PC A02/MF A01; 1	DE84000451	MN -38	8:56294
83-2092C	NTIS, PC A02/MF A01	DE84000464	MN -71	8:55495
83-2100C	NTIS, PC A02/MF A01; 1	DE84000352	MN -92a	8:55463
83-2134C	NTIS, PC A02/MF A01	DE84000353	MN -34	8:55994
83-2135C	NTIS, PC A02/MF A01; 1	DE84000943	MN -92a	8:55457
83-2140C	NTIS, PC A02/MF A01	DE84000483	MN -92a	8:55458
83-7021	NTIS, PC A05/MF A01; 1	DE84000963	MN -63c	8:55599
83-7024	NTIS, PC A08/MF A01	DE84000967	MN -63c	8:55600
SERI/STR-				
254-1515	NTIS, PC A10/MF A01; 1	DE83011993	STD -59	8:55620
SERI/TP-				
234-1964	NTIS, PC A03/MF A01	DE84000010	MN -61a	8:55572
252-2055	NTIS, PC A02/MF A01; 1	DE84000001	STD -62e	8:55624
SGP-TR-				
60	NTIS, PC A15/MF A01; 1	DE83015865	MN -66a	8:55699
SLAC-PUB-				
3102	NTIS MF A01; 2	DE83018085	MN -34D	8:56608
3124	NTIS, PC A02/MF A01	DE83018084	MN -34D	8:56609
SU-IPR-				
953	*See* AD-A-127652/6			8:56534
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5361-003	*See* DOE/CS/54266-3	DE84000524	MN -96	8:55935
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468	*See* N-8324576			8:56246
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4224-71-83	*See* PB-83-228429			8:55924
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375	NTIS, PC A03/MF A01; 1	DE84000251	MN -98D	8:55584
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17271-83	NTIS, PC A05/MF A01; 1	DE83017999	MN -34	8:55843
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19663-83-1	NTIS, PC A18/MF A01; 1	DE84000038	MN -25	8:56080
19849	NTIS, PC A05/MF A01	DE84000516	MN -25	8:56090
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19869	NTIS, PC A04/MF A01; 1	DE84000973	MN -20d	8:56727
19873	NTIS, PC A10/MF A01; 1	DE84000526	MN -34	8:56803
19878	NTIS, PC A03/MF A01; 1	DE84000186	MN -20	8:56771
19880	NTIS, PC A05/MF A01; 1	DE83018227	MN -11	8:56525
19889	NTIS, PC A02/MF A01	DE83017987	MN -32	8:56804
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IB	International Bank for Reconstruction and Development
ID	Indonesia
IE	Ireland
IG	Inter-Governmental Maritime Consultative Organization
II	International Commission on Radiation Units and Measurements
IL	Israel

IN India
IO International Labor Organization
IP International Union of Pure and Applied Physics
IQ Iraq
IR Iran
IS Iceland
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IX International Union of Pure and Applied Chemistry

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OM Oman

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PG Papua New Guinea
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TD Chad
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TH Thailand
TN Tunisia
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TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UE United Nations Educational, Scientific and Cultural Organization
UF United Nations Children's Fund
UG Uganda
UI United Nations Industrial Development Organization
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Viet-Nam
VE Venezuela
VS Republic of Viet-Nam

WM World Meteorological Organization
WS Western Samoa

XA International Atomic Energy Agency (IAEA)
XC European Organization for Nuclear Research (CERN)
XE Commission of the European Communities (CEC)
XF Food and Agriculture Organization of the United Nations (FAO)
XJ Joint Institute for Nuclear Research (JINR)
XM Council for Mutual Economic Assistance (CMEA)
XN Nuclear Energy Agency of the OECD (NEA)
XO Organization of African Unity (OAU)
XR International Commission on Radiological Protection (ICRP)
XS International Organization for Standardization (ISO)
XU United Nations (UN)
XW World Health Organization (WHO)
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YD Democratic Yemen
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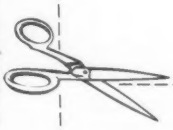

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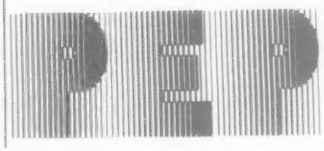

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